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CONTENTS

Railway Wages

THE rejection earlier this week by the Railway Executive of the three railway trades unions' claim for a 10 per cent. rise in wages and extra pay for Saturday working was to be expected. The present economic situation of the country and the compensation for price increases in the last two years by wage awards, both of which factors led the Chancellor of the Exchequer, Mr. R. A. Butler, to make his recent appeal for wages restraint, alone are sufficient reason for rejection of the railwaymen's claim. In addition, the financial position of nationalised transport, where the small revenue surplus for 1951 is likely to be much more than offset by increased costs, a falling off in merc. lise traffic on the railways, and Government intervention in passenger fares, does not justify increasing outgoings by some £17 million a year, which would be the cost of the increase demanded. The Railway Executive on this occasion has rejected the claim outright, whereas it made an offer in response to the previous claim by the railway unions lodged in July, 1951, which resulted eventually in the award effective from September—and in further increases in freight rates and passenger fares. This seems to show that the Railway Executive knows itself to be on firm ground. Last year's award cost over £14 million a year, and in general has offset increases in living costs. Given the statutory obligation on the British Transport Commission to take all possible steps to pay its way, there could hardly be an alternative to rejecting the railwaymen's latest claim. Negotiations have only begun; the unions are to appeal to the next stage of the negotiating machinery, the Railway Staff National Council, and proceedings may be long. Any increase in wages, unless the Government abandons existing principles of transport finance, must lead to further increases in railway charges. Meanwhile, busmen in London and the provinces, besides many workers less directly connected with transport, have lodged wage claims, and the Trades Union Congress has sought elucidation from Mr. Butler of his appeal for wages restraint.

Warning on Late Deliveries

A STATEMENT by Mr. Sauer, South African Minister of Transport, in the House of Assembly on June 18 emphasised the importance of close adherence to delivery dates if British manufacturers are to retain their markets in South Africa. He quoted some examples of delayed deliveries from this country, among them being 40 electric locomotives and 32 electric motor coaches. In saying that the first of the locomotives had not arrived nor was there any sign of them, however, Mr. Sauer was slightly in the wake of events, for one locomotive reached the country on June 16, and the second is at sea. Many of the manufacturers' difficulties here stem from the uncertainty of steel supplies, and if Mr. Sauer's statement leads to allocations being revised it will not have been without benefit however unpalatable it may sound. It should be recognised, also, that electric traction equipment is susceptible to technical problems arising between design and production, some of which may be due to a change, not foreseen at the time of placing the order, in the type of service for which it is desired to use the units. Another complication is that fixed equipment for electrification may be available before the motive power units, a fact that increases pressure from the public to expedite the improved electric services they have been promised.

Export of Engineering Products

THE British Engineers' Association has published tables of the total values of exports from and to many countries of engineering products for the three years 1949-50-51. These show foreign competition in particular markets and emphasise the changes taking place. The products include railway material such as signal, track, and electrical equipment, but not locomotives or rolling stock. The smaller engineering exporters such as Austria and Denmark are not dealt with, nor the Iron Curtain countries, for which reliable statistics are not available, though Czechoslovakia, for instance, exports engineering products to a considerable value. The U.S.A. heads the list of exporters, with a total value exported in 1951 of £818 million, against £561 million in 1949. Corresponding figures for the United Kingdom are £462 and £359 million, for Western Germany £249 and £36 million, for France £129 and £69 million, and for Switzerland £98 and £59 million. No comparable statistic is available for Japan, whose exports nearly doubled in 1951 compared with 1950. Tables of destinations show that West German exports were directed to nearly all the world's markets, whilst Japanese exports tend to be limited to South and South-East Asia, so that particularly in India, Pakistan, and Indonesia, exports from Japan were of considerable importance.

Rhodesia Railways Magazine

FOR some thirty years the *Rhodesia Railways Bulletin* has rendered a valuable service in keeping the often widely-scattered members of the staff well informed of developments. The continued increase in the number of staff and the growth of the system, with its present route mileage of 2,436, has encouraged the administration to produce a more comprehensive successor, *Rhodesia Railways Magazine*, of which the first issue, dated May, 1952, has appeared. With messages from Sir Clarence Bird, Chairman, and Sir Arthur Griffin, General Manager, Rhodesia Railways, and from the Prime Minister of Southern Rhodesia and the Governor of Northern Rhodesia, the new journal makes a good beginning. A balance is kept between contributions of local and

more general interest. There are articles describing advantages and disadvantages of diesel traction, how railway communications were maintained during a period of flood which threatened the Kafue and Hunyani bridges, and on surveying the Rhodesian section of the projected new line towards Lourenço Marques, which will give Rhodesia the use of another seaport.

Overseas Railway Traffics

DURING April there was a £27,000 decrease to £707,000 in Canadian National Railways net revenue, as a result of a further advance in operating expenses. Operating revenues for the month were £1,089,000 higher at £17,908,000, and the rise in operating expenses, amounted to £1,116,000 at £17,201,000. On the aggregate net revenue for the current 17 weeks is down by £787,000 at £2,409,000, though operating revenues have advanced by £7,364,000 to £71,822,000. Aggregate operating expenses since January 1 amount to £69,413,000, as compared with £61,262,000 for the equivalent period of 1951. In the first month of the financial year beginning April 1, 1952, Gold Coast traffics improved by £29,019 to £323,411, following a £335,178 advance to £3,475,842 in the financial year 1951-52. Costa Rica receipts for May rose by c986,013 to c1,552,666 and one month before the close of the financial year 1951-52 had made an aggregate advance by c4,220,309 to c14,398,842.

Controversy over a Bridge Detail

A CONTROVERSIAL point which was raised in the introductory note to a paper at the Institution of Civil Engineers on "Economy in Railway Engineering," was whether the flanges of the bottom chords of truss girders should be turned inwards or outwards. The matter gave rise to considerable discussion when the paper was presented. The author of the note favoured inward-turned flanges, because (*a*) they offered an unobstructed gusset-face to the cross girders, (*b*) it was easier to fit vertical and diagonal members between the outstanding gussets than between gussets inside the chords, and (*c*) they simplified the details at the end connections to the rakers. Other speakers pointed out that quite satisfactory connections of the cross-girders could be made with outward flanges, and that a concentrated joint was very desirable and could more easily be obtained when the chord flanges were outwards. Moreover, larger gussets and more material were involved with inward flanges. The author replied that all members should converge on the same point on the axis of the chord itself. Other pros and cons were voiced by both sides and no agreement was reached.

The U.S.A. Diesel Invasion

NOTWITHSTANDING the gloomy view of the diesel invasion of the railways in the United States taken by the few remaining defenders of steam locomotive power in that country, as expressed in our correspondence columns from time to time, it is clear that those responsible for operating the great majority of American lines have no doubts as to the wisdom and economic value of what they are doing. During 1951, a further 4,071 diesel units were put on order by U.S.A. railways, and although this number fell short of the 4,473 units ordered in 1950, this was mainly because the demand on manufacturing facilities in the former year had been so great that a considerable backlog of orders had to be carried forward from 1950 into 1951. In 1951 a record was established in that 99·1 per cent. of all the orders by U.S.A. railways for locomotives were for diesel power. As regards individual railways, the Pennsylvania has ordered 1,068 units in three years, and the New York Central 916 units in two years. By the end of August, 1951, 60 per cent. of the passenger train mileage in the United States was being operated by diesel power, as compared with 34 per cent. by steam and 6 per cent. by electricity; in freight locomotive mileage the corresponding figures were 48·5, 50, and 1·5 per cent., and in yard shunting-hours 66·5, 30, and 3·5 per cent. respectively.

New Third Class Stock for Egypt

ELSEWHERE in this issue is described and illustrated the new third class passenger stock at present being constructed by the Metropolitan-Cammell Carriage & Wagon Co. Ltd. for the Egyptian State Railways. This stock comprises passenger coaches with brake compartments and also passenger coaches with buffet compartments. Both types are basically similar in design and have seating accommodation for 104 passengers. The bogies, built to E.S.R. design and of riveted construction, are equipped with British Timken roller bearings; the underframes are of all-welded construction. The body framing is constructed of steel pressings, and a flush exterior is obtained by jogging the body pillars at the panel joints; these latter being welded and ground flush. The roof is constructed as a separate unit. The carriages are insulated by spraying of Limpet asbestos to the roof and sides. The floors are finished in Induroleum laid on galvanised corrugated sheeting and coved at the sides to facilitate cleaning.

Frozen Meal Service on Trains

THE losses of American railways in their dining car operations are being reduced substantially on certain lines by an experimental use of modern refrigeration methods. As reported in the Overseas section of our March 14 issue, central kitchens are being used to precook meals, which are then prepared in portions ready for serving and subjected to deep freezing. Each dining car is supplied with a range of meals in this frozen form, and the various constituents are stored in capacious refrigerators. At meal-times passengers order their selection on meal checks, and the hot dishes are brought up to serving heat in special electric ovens in about 10 min. Meat can be cooked in an underdone or overdone condition, and so served after refrigeration and re-heating, so that the personal preferences of passengers can still be studied. The economy of the method lies in the considerable reduction of both staff and waste by concentration of the cooking in central kitchens, while work on the trains is much simplified by the fact that all the portions are stored ready for service. The Chesapeake & Ohio, Chicago, Rock Island & Pacific, and New York Central lines are all trying the experiment, with successful results.

Rail Defects

THE latest report on rails of the Association of American Railroads' Central Research Laboratory shows that controlled cooling after rolling has proved a complete protection against the development of the dangerous transverse fissure defect in high carbon rails. Rail failure statistics covering some 250,000 miles of main-line tracks in the United States reveal that the most serious types of rail defect today are cracks in webs starting from the right-angled edges of fish-bolt holes, and failures which start from the shelling of the running surfaces of rails. As to the latter, it is recognised that the gauge corner of the rail-head tends to get cold-worked under traffic, and so to lose its ductility, with the result that thin layers of steel flake off in a horizontal direction. Experiments are to be made to ascertain if it is possible to relieve the surface stresses by the use of an oxy-acetylene torch, thus restoring ductility and eliminating the tendency to shell. An investigation is also to be made to determine, if possible, what changes are possible in the finishing of fish-bolt holes in order to round the sharp edges and so to do away with the angles which form stress concentration areas and the starting-point of fatigue cracks.

Train Control Developments on the Pennsylvania

FURTHER expenditure was authorised in 1951 for the extension of cab signalling and automatic train control on the Pennsylvania Railroad. The company's report states that an outlay of $1,698,000 was allocated to providing cab signalling between Columbus and New Paris, Ohio, which will add 161 miles of track operated with this system of control. Already the company operates the

highest track-mileage in the United States equipped with cab signalling, the present total being 3,623 track-miles. Automatic train control employing an electronic link between track and train is to be applied to 173 electric, 134 diesel-electric and 13 steam passenger locomotives, for which purpose an expenditure of $2,082,000 has been authorised. When this equipment is installed, the Pennsylvania will be operating a higher total than any other railway in the United States of locomotives in which failure of the driver to comply with signalling indications is followed by automatic application of the train brakes. Automatic train control devices using a d.c. inductive system for transmitting control effects have been installed on a wide scale in the United States for some years, as it has been found that adverse weather conditions are liable to cause failure in the operation of equipment depending for its operation on contact between the track equipment and the locomotives.

4-6-0 Locomotive Power

THE capacity of the British mixed-traffic 4-6-0 locomotive is often taken advantage of up to the limit, while operating departments endeavour to go above it, with consequent loss of time despite high coal consumption. Things are not as bad as in 1945-49 when, with a shortage of main-line power in good condition, class "5" engines of the L.M.S.R. were, for example, often found on trains needing a "5XP" or a class "6" engine. Tests undertaken by British Railways show existing 4-6-0 types to have a wide and useful medium power range, though before the limit of output is reached—because of grate, front end, or other conditions—coal consumption tends to rise sharply. The G.W. "Hall" class, for example, is more sensitive to coal type than the ex-L.N.E. class "B1." When burning South Wales coal it can exert up to 1,250 d.b.h.p. at 30 m.p.h., 1,250 at 40, 1,200 at 50, and 1,060 at 60 m.p.h., with corresponding coal consumptions with "test" firing of 2·35, 2·35, 2·5 and 2·75 lb. per d.b.h.p.-hr. With Blidworth coal, however, actual d.b. output is 8 per cent. less, and the specific consumption much increased at the highest outputs. On the other hand, the "B1" showed appreciably higher outputs than the "Hall" at speeds above 50 m.p.h. when both were burning Blidworth coal, and at a lower specific consumption; above 60 m.p.h. it was better even than the "Hall" when the latter was burning its "home" South Wales brands. But the "B1" has much the lower maximum outputs at 20 to 40 m.p.h.

Finding a Purchaser

AMONG those who value nationalisation as a matter of principle or doctrine, there is support for measures to carry out the process so thoroughly that its reversal would be impracticable. In present circumstances it may be found that the disposal of nationalised undertakings to private interests presents difficulties even when a less drastic policy has been followed and only a short time has elapsed since nationalisation took effect. The sale of road haulage units proposed in the White Paper on Transport is likely to present problems in finding purchasers, for much of the money paid to previous owners will no longer be available for buying the undertakings back, and restrictions on capital do not make it easy to raise loans. The coming Transport Bill, therefore, may have to embody some modification of the Government's policy as expressed during the debate on the White Paper on the purchase by the railways of their former road interests, in case other buyers are not readily forthcoming.

In his contribution to the debate last month, Sir Ralph Glyn urged that it was essential to an efficient railway service that the railways should be allowed a certain amount of road transport. He quoted the 45 road haulage undertakings formerly owned or controlled by the main-line companies, who had fought hard to get them in order to improve the public service, and he asked what was to happen to them. Earlier the Minister of Transport, Mr. A. Lennox-Boyd, had said that the railway companies were divested of their road interests on nationalisation and it was not the intention of the Government that those interests should be restored. He further stated that their purpose was not to transfer from one nationalised industry to another vital national assets that were not being adequately used. At the conclusion of the debate, however, some relaxation of this line appeared in Mr. Gurney Braithwaite's specific reply to Sir Ralph Glyn that there might be special circumstances where it would be a good thing to let the railways buy, and that such a possibility certainly would be considered.

That some difficulty in finding purchasers has been foreseen by the Government was acknowledged by the Minister's statement that the question of whether any particular facilities would be needed by intending purchasers of transport units would be watched with particular attention, but he added that any action must be consistent with general monetary policy. There is ground, therefore, for expectations that the railways may be given certain opportunities for acquiring road undertakings additional to the normal feeder and delivery services. The extent to which this is permitted probably will depend on the readiness of other purchasers to come forward, and events may enforce considerable modification of the Government's attitude as expressed so far, which appears to be that the railways should be low down in the list of purchasers if, indeed, they figure there at all. A statement furnished recently by the Minister in response to a question in the House of Commons showed that the value attributed to shareholdings in road haulage undertakings owned or partly owned by the former railway companies, and vested in the British Transport Commission on January 1, 1948, was £6,184,597. The number of vehicles (excluding those of companies in which the railways did not hold a controlling interest) was 3,558, and combined profits for the last full year before nationalisation were £772,309. We have already expressed our view that these undertakings should have been permitted to revert, the remainder being put up to auction in which the railways would bid on equal terms with the public. A policy of splitting up large units simply to prevent them returning to those who controlled them before would be a needless obstruction to the development of undertakings that have proved their utility to the public in unified form.

Summer Train Services, Scottish Region

LITTLE change from the train services operating in the Scottish Region during the summer of 1951 is seen in those of this year. Some of the innovations of last year, such as the through daily restaurant car service between Manchester and Perth, with through coaches between Manchester and Aberdeen, reappear. One facility which has been given during several past summers, however—the through service between Glasgow Queen Street and Oban *via* the West Highland line to Crianlarich—is withdrawn.

On Friday nights the service from London to Oban is greatly accelerated; the 7.30 p.m. from Euston, with through coaches and sleeping cars, is due in Oban at 8.5 instead of 9.10 a.m. This train also conveys through coaches from Manchester to Perth. On Saturdays numerous extra express trains between Glasgow, Perth, and Inverness are augmented by a new 1.15 p.m. train, calling only at Stirling, Perth, and Stonehaven, and due in Aberdeen at 4.41 p.m. This timing of 3 hr. 26 min. is the fastest between Glasgow and Aberdeen since before the war, when the summer service included two 3-hr. trains in each direction. A number of trains have minor accelerations, up to 5 min., between Glasgow and Perth in each direction; the southbound "West Coast Postal" from Aberdeen to the south, temporarily leaving Aberdeen at 3.27 p.m. during the winter, to allow for slowing over a viaduct under reconstruction near Strathord, reverts to its usual 3.30 p.m. departure.

On the East Coast main line the unaccountably slow timings between Berwick and Edinburgh still remain, and are in striking contrast, both to the high standard of speed

established by the North Eastern Region between York, Newcastle, and Berwick, and those on the West Coast main line between Carlisle and Carstairs. Some of the Edinburgh-Berwick schedules are even increased, such as that of the southbound "Heart of Midlothian," now allowed 74 min. instead of 69 min. for the 57.5 miles. Other trains are allowed up to 77 min. non-stop, and 82 min. with a Dunbar stop; in the reverse direction, which from time to time is run in 60 min., or a little over, by trains regaining lost time, the non-stop bookings range from 70 to 83 min.

The usual express connection is provided from Edinburgh to Aberdeen to convey the through coaches off the "Capitals Limited," but though the latter this summer reaches Edinburgh Waverley at 4.41 instead of 4.50 p.m., no alteration is made in the 5.5 departure for Aberdeen, so that through passengers are involved in a wait of 24 min. North of Aberdeen, restaurant car service, withdrawn during the currency of the winter timetable, is restored on the 8.8 a.m. from Aberdeen to Inverness and the 12.45 p.m. from Inverness to Aberdeen. On Saturdays, the 8.45 a.m. summer express from Elgin to Aberdeen leaves at 9 a.m., and is accelerated 14 min. On the Highland line, the 9.25 a.m. restaurant car train from Edinburgh Waverley to Inverness is decelerated by 11 min., arriving at 3.7 instead of 2.56 p.m.

Between Glasgow and Carlisle there is a further slight tightening up of the fast schedules to which previous reference has been made; two trains are scheduled over the 66·9 miles from Symington to Carlisle in 68 min. (59 m.p.h.) and two over the 73·5 miles from Carstairs to Carlisle in 75 min. (58·8 m.p.h.), start to stop in both cases. In the reverse direction, however, the 9.10 p.m. sleeping car train from Euston reaches Glasgow at 6 a.m., 10 min. later, and the 9.25 p.m. from Euston at 7.28 a.m., 8 min. later. The 1.15 p.m. "Midday Scot" from Euston arrives in Glasgow at 9.35 instead of 9.45 p.m., 10 min. earlier. There are several other minor accelerations over this section.

Civil Engineering in the Colonies

TWO papers, Relaying and Maintenance, Nigerian Railway, and Rehabilitation of the North Borneo Railway, presented at the Institution of Civil Engineers on June 18, and summarised in our issue last week, were followed by a discussion. Mr. R. W. Foxlee, Engineer-in-Chief, the Crown Agents for the Colonies, referred to the shortage of steel, and said that in view of this, the paper dealing with the Nigerian Railway was of particular interest. An important point for consideration was the possible use of indigenous materials on Colonial railways. Although it might be uneconomical in some cases, we might, by force of circumstances, be compelled to adopt such a procedure. Furthermore, with the increased cost of certain materials; rails, he believed, were some six times dearer than before the war, or it was open to question whether sufficient sums were put aside for replacements and so on. Regarding timber sleepers, he thought that the cost of indigenous timbers for this purpose would vary considerably, but in view of the steel shortage it was not altogether a question of economics. Obviously certain timbers would be more suitable than others, and it was a question of finding out which were the more suitable.

Referring to the North Borneo Railway, Mr. D. C. Brown, of the Crown Agents for the Colonies, said that it was not until the middle of 1946 that the British Government took over responsibility for its administration from the British North Borneo Company. North Borneo was approximately the size of Scotland with little more than 200 miles of metalled roads and some 116 miles of railway. Due to the damage caused during the war, the rehabilitation of the railway was obviously an undertaking of considerable magnitude, especially in view of the shortage of labour. The paper presented an excellent view of the conditions under which the North Borneo Railway operated. Sir Hilton Poynton, Joint Deputy Under-Secretary of State, Colonial Office, referred to the considerable benefit of the liaison between that office and the Crown Agents for the Colonies. Sir Hubert Walker, Chairman of the Session, proposed a vote of thanks to the authors.

This was the third conference held under the auspices of the Institution of Civil Engineers. It is hoped to arrange a further conference in 1954, which will no doubt afford a further useful occasion for the exchange of expert views and experience on civil engineering matters.

Prospects of the U.S.A. Railways

IN our June 13 issue we were glad to print a letter from Mr. Herbert Ashton, Washington, D.C., which raised an important point about the downward trend of U.S.A. railway less-than-wagonload traffic. For the first 20 weeks of this year the number of wagons carrying "smalls" has decreased by about 8 per cent. compared with 1951. Mr. Ashton rightly suggested that a considerable proportion of the tonnage, which the railways appeared to have lost, might still be passing as forwarder traffic in full wagonloads. His letter prompted us to look further into the problem of dealing with small consignments by rail and the results of our enquiry are sufficiently instructive to be worth setting out in detail.

The earliest record of forwarder traffic is for 1939, when it amounted to 2,797,000 tons. The business expanded during the war years, reached a peak of 4,738,000 tons in 1947 and accounted for 4,467,000 tons in 1950. Dr. J. H. Parmelee, Vice-President, Association of American Railroads, told a Senate Committee in September, 1950, that the forwarding agents were interested primarily in long-distance "smalls," which they collected at places where a wagonload could be accumulated readily. They charged the traders less-than-wagonload rail rates and paid the railways wagonload charges. There was no profit to the agents in short-haul traffic. The average haul of the merchandise they handled was around 1,1000 miles—nearly double the average distance for smalls delivered directly to the railways by senders.

In 1939 the tonnage of less-than-wagonload traffic was 14,875,000. The volume was inflated when wartime conditions restricted road transport, reaching 22,561,000 tons in 1947. Then came a headlong descent to 10,887,000 tons in 1950, a decrease of 51 per cent. Together, forwarder and less-than-wagonload traffic represented in 1939 about 1.9 per cent. of the total tonnage originated by the U.S.A. railways. In 1947 the ratio became 1.7 per cent. and afterwards dropped by 0.2 per cent. each year until it stood at 1.1 per cent. in 1950. Put in another way, while total tonnage increased by 50 per cent. between 1939 and 1950, the combined weight of forwarder and less-than-wagonload merchandise decreased by 13 per cent.

In the interval of 12 years, the forwarding agents increased their share of the combined traffic from a sixth to more than a third. In 1950 they paid the railways rather less than $33 a ton on their bulked traffic, about half a dollar more than the average revenue earned by the railways from a ton of less-than-wagonload traffic. When the Interstate Commerce Commission authorised the railways to increase freight rates, subject to certain limits, by 15 per cent. in May this year, it gave freight forwarders leave to advance their charges rateably at the same time and may have helped them to widen the field of their activities to a moderate extent.

The decadence of a one-time profitable traffic has been discussed at several conferences between the railways and traders. Various plans have been proposed for improving the transit time of "smalls." One plan was on much the same lines as the "nominated loading" scheme tried in this country some 35 years ago. A common policy has not been settled and few companies are reputed, like the St. Louis South-Western, to cater specially for "smalls" to the stage of making their conveyance remunerative. Things may have reached such a pass that the railways would not suffer any serious loss if the handling of "smalls" were left almost entirely to forwarding agents and the Railway Express. Possibly the 1951 statistical bulletin, due in October, will throw fresh light on the question.

Special Features of Fire Risks

WE have already made brief reference to the appearance of Colonel R. J. Walker's report on the fire which broke out on July 14, 1951, in the down "West Riding" express near Huntingdon, and a summary of it now appears in this issue. Following so soon on the alarming Penmanshiel and Beattock fires, the case called for further consideration of the recommendations Colonel Walker saw fit to make in connection with them. The facts brought to light by those fires led to a number of recommendations made by him being referred by the Ministry of Transport to the Railway Executive. Some eight of these, the most serious being that nitro-cellulose lacquer should be removed from all coaches, were accepted and active progress has been made with applying them. Some refer to new vehicles only.

Considerable expense has been incurred in the work. Further details of what has been done were given in our May 23 issue and these measures were referred to also by Lord Leathers in replying to a question in the House of Lords on June 8, as reported on another page. His allusion to the building of all-steel sleeping cars related, of course, to decisions taken as long ago as 1948, when all-steel construction was adopted for all future corridor stock, both sleeping cars and ordinary coaches. Three other recommendations covering organising train staffs to deal with fires and provision of centre doors in open corridor coaches and sleeping cars were not found acceptable, for reasons fully set out in the Huntingdon report.

The argument has been used that somewhere the line must be drawn in providing safeguards against accidents and a balance effected between the degree of risk and the cost of removing it, for some risk there must always be. This consideration is applicable indeed to all kinds of accident and where risk is already very small there is no justification for spending large sums, particularly if they involve in turn appreciable additional maintenance charges, merely to reduce it by what can only be an infinitesimal amount. It may be said here that Colonel Walker makes no suggestion that the railway authorities are not fully alive to the need for and essential rightness of, attaining as high a measure of safety as is reasonably possible and indeed the great relative freedom from serious accident achieved in British railway working over so many years bears eloquent witness to it. That will not be questioned by anyone having a knowledge of this subject. The old adage that there is reason in all things admittedly has much force in this connection. Nevertheless there is an essential difference between fire and other types of risk met with on railways and that is its power of spreading. At Huntingdon the one small incident destroyed four vehicles. We concur with Colonel Walker in thinking that the ordinary calculations are not applicable and that the fire danger must be regarded in a somewhat different light from others.

A feature of the Huntingdon case was that the coaches, having been constructed originally for a special service, in which an unusually large number of train attendants was carried, had no communication chains in the main body portion, only at one outer end, which led to time being lost in finding means of raising an alarm. Passenger communication is still governed by legislation passed in 1868, before there were corridor vehicles here, which called for means of attracting the attention of those in charge of a train if it ran more than 20 miles without a stop. The Board of Trade had to approve the apparatus used. The original cord system, the difficulty of operating which gave rise to the popular lines "if five pounds you can afford, try your strength and pull this cord," became disallowed in 1873, but continued in use nevertheless. Some companies, mostly in the south, applied electrical systems, one remaining in use, we believe, on some Brighton line trains down to grouping. The system now generally used, fully approved in 1893, of acting partially on the continuous brake, appears first to have been applied, with the automatic vacuum, in 1886 on a Russian railway by Thomas Urquhart. It appeared here on the Manchester, Sheffield & Lincolnshire line in 1890 and won general favour in due course. Colonel Walker recommends that the whole question be reviewed, to ensure adequate fittings in all coaches, approved by the Ministry of Transport. to whom that power passed in 1919.

The fact that a serious burnout has occurred in a supposedly safe vehicle since he wrote his report is an added reason for expecting the new outlook he asks for to be unreservedly adopted and nothing reasonable left undone to banish at least those conditions under which a coach can be found blazing from end to end within a few moments of flame being seen. The need for protecting a stopped train against certain recognised potential dangers, for most of which the block telegraph and signals ought ordinarily to provide, is admittedly important, but fire in a train presents an immediate pressing danger of the gravest kind, and, as Colonel Walker thinks and we feel also, calls for concentrated attention, even if other things must for the time being be put aside.

Paris-Lyons Electrification Completed

SINCE June 24 trains have been hauled electrically throughout between Paris and Lyons, following the completion of the final section, from Chalon-sur-Saone to Lyons, of this 318-mile main line. The first section to be electrified was between Laroche and Dijon, inaugurated for all services in March, 1950; the subsequent stages were Laroche-Paris, in August, 1950, and Dijon-Chalon, in January last.

Services have been considerably accelerated. The journey from Paris to Dijon, 196 miles, by the fastest train has been reduced from 3 hr. 46 min. with steam traction in 1950 to 2 hr. 32 min. with electric traction—an average speed from start to stop of 77 m.p.h. In October, the fastest time for the journey from Paris to Lyons will be reduced to 4 hr. 15 min., an average speed of 75 m.p.h., including a stop at Dijon, compared with the best timing by steam train of 6 hr. 7 min. in 1950.

The electrification has brought about great economies in operating expenses. The work formerly performed by 600 steam locomotives is now carried out by only 225 electric locomotives, requiring less repair and maintenance. The weight of *rapide* trains has been increased from 600 to 800 tons, allowing more seats per train, and the higher speeds achieved and the improved signalling enable more trains to be run. Goods trains between Lyons and Paris hitherto running *via* Moulins or *via* Bourg are being concentrated on the main line to enable the maximum advantage to be gained from electrification.

Train crew expenses are lower because of the longer trains and because electric locomotives can haul trains for much longer periods than steam locomotives before having to return to depot. Finally there will be a great saving in the consumption of coal. Nearly half the current required is being supplied by hydro-electric power stations and the remainder, provided by thermal power stations, involves the use of less coal and of an inferior quality, to generate the same amount of energy as that provided by steam locomotives. Two-thirds of the current required will be taken from the power stations between 8 p.m. and 8 a.m. when normal industrial and commercial consumption is at its lowest.

The complement to this great scheme, the electrification of the triangle Macon-Ambérieu-Lyons, and the prolongation to Culoz, is in progress. When it is completed, expresses from Paris to Italy *via* the Mont Cenis and to Geneva and the resorts of the French Alps will not turn off the Paris-Lyons line at Dijon, as now, but continue on it to Macon—again to ensure maximum use of the main line—and rejoin the existing route at Bourg. From Culoz to Modane, where the Italian State Railways take over, the line was electrified by the P.L.M. at 1,500 volts between 1930 and 1936. Electrification between Macon and Culoz will therefore make possible electric haulage between Paris and Villa San Giovanni, at the southern tip of Italy, some 1,320 miles.

E

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Railway Receipts

May 26

SIR,—To anyone experienced in railway operation at home and abroad the causes of our transport troubles are outstanding and glaring. First, there is the exaggeratedly high level at which ordinary and season ticket fares are retained. You may have noticed that while these traffics are continually declining, receipts from so-called " cheap " and excursion fares (which are even higher than ordinary fares by motorcoach) are always increasing.

So clear an indication should have been sufficient guidance to reduce ordinary fares to the same level, when people would be able to travel more cheaply whenever and wherever they liked, instead of being confined to particular days, trains and places. Naturally, most people would sooner put the difference between present road and rail fares into the pockets of their children, rather than make a free gift of it to the railways.

The inability of the Rates Tribunal to understand this simple proposition is responsible for its failure to comply with the principal objects for which it was established, that is, to reduce rates and fares to a mileage scale, eliminate millions of confusing special charges and restrictions, to secure equality all over the country.

The second great cause has been the failure to replace the present small wagons by 20-ton and 40-ton wagons—as Royal Commissions, the principal traffic officers, and many large industries have repeatedly but vainly urged—which would have secured heavy economies in all directions.

The railway administration should now be called on to concentrate resolutely on these particular aspects of its work, instead of grumbling about the cost of the upkeep of the tracks. In my sixty years' experience at home and abroad I have never yet heard any other railways complaining of the cost of upkeep of tracks, although most of them are obliged to import all their parts, steel sleepers, rolling stock, and other materials at heavy additional expense. Yet they continue to pay dividends at less than half the British rates and fares.

Yours faithfully,

E. R. B. ROBERTS

Eynesbury, St. Neots

Diesel Publicity

June 17

SIR,—The one major factor in the rise of the diesel-electric locomotive which receives no publicity is the fact that opposition, if any, is negative. The wildest and most irresponsible statements therefore go unchecked, and only the amateur is sufficiently interested to raise a protest.

I wonder, assuming that there were such an organisation with a good public relations department, what the reaction would have been to the recent announcement that dieselisation had such a disastrous effect on the tracks of the New York Central that the famous " Twentieth Century Limited " had been slowed down and the maximum speed reduced? The immediate result would be that every diesel enthusiast would be on the defensive and seeking excuses, yet when an American correspondent suggested more than six months ago that such a course might be necessary, he was howled down.

Mr. Bell and your own columns have given figures based on the latest U.S.A. operating results and credit is given to the diesel for what is certainly a major improvement in efficiency. The fact remains that it would have been a physical impossibility to expend the sums involved on new motive power, regardless of its type, without getting such an improvement. Nor has anyone come along with concrete proof that the job could not have been done cheaper and nobody has suggested what will happen should trade fall off and the enormous capital outlay has to be carried on diminished traffics.

One has to go to Australia to meet a form of hysteria about the diesel which verges on the worst efforts of Hollywood. The replacement there of an unsuitable steam locomotive, valued at £17,000 fifteen years ago, by a diesel unit worth £103,000, has permitted the re-establishment of the schedule operated easily by the steam locomotive before the war. This has received about ten times the publicity accorded the original acceleration—which was a good effort. In addition, I am told that eleven diesel locomotives are to replace 43 steam locomotives, that one diesel fitter will replace five steam men, and more in the same strain.

Having read in your own columns American figures which proved that the fitting of a diesel engine and generator to an electric locomotive had the effect of improving availability some four or five times, I suppose I can resign myself to believing things like the foregoing as well.

Yours faithfully,

L. IRVINE-BROWN

Hill House, Halton, Runcorn

The White Paper and British Railways

June 15

SIR,—As a lone critic of Mr. G. L. Nicholson's letter in your May 23 issue, allow me to say that something more dynamic is needed at the present time than another reorganisation in new areas called Railways, and reviving some of the traditional names and liveries of the past: further should there be a deep probe into the industry from top to bottom to obtain simpler management and supervision at all stages, less unproductive time, and lower costs and fares, so that the public can make the most use of its transport system, with general benefit to all.

The concluding part of his letter that railway trade unions and the Railway Officers' Guild must safeguard their interests and contribute to the solution of the problem of management, appears to be the phraseology of other industries besides the railways; in fact it means a lot of self-interest with consequent higher living costs to everyone.

Yours faithfully,

ROBERT W. LEWIS

104, Leggatts Way, Watford

[The operating efficiency reflected in the 1951 results of British Railways suggests that the Executive is already tackling the problems of unproductive time and simpler management itself, and with good effect.—ED., *R.G.*]

Lightweight Diesel Train

June 23

SIR,—If in spite of Mr. H. Stephenson's strictures in your June 13 issue, the Railway Executive decides to introduce lightweight diesel trains of the type recently demonstrated, the opportunity would arise for breaking away from traditional timetable practices. Branch lines with independent shuttle services (existent or defunct) could be linked by through trains, such as Watford (L.T.E.) to Chesham, or Watford Junction to St. Albans and Hatfield. Trains for Christmas shoppers used to be run on the former route, avoiding the changes at Rickmansworth and Chalfont & Latimer. The Hatfield journey (which involves a change by bus) would facilitate travel from West Herts to Grantham, Doncaster, and beyond, presuming the Railway Executive pursues its policy of stopping main-line trains at outer suburban stations. New facilities are likely to be as effective as new equipment in attracting traffic to the railways.

Yours faithfully,

" FOUR-WHEELER "

London, S.W.1

THE SCRAP HEAP

After You

There is still a law in Kansas which states that when two trains approach each other at a crossing, they shall both come to a full stop, and neither shall start up until the other has gone.—*From "Ad Rem" the house magazine of the Butterley Co. Ltd.*

Paddington in Stained Glass

A new west window for St. James's, Sussex Gardens, the parish church of Paddington, will include scenes depicting the close association of the church with the life of the borough—its vicars have been honorary chaplains to Paddington Station for more than a century. Among the scenes chosen is a vista of the interior of Paddington with the "Cornish Riviera Express" ready to leave on its westbound run.

Railway Savers in the Midlands

Since Mr. A. T. Gray started a savings group in 1939 for the staff of the Nottingham Victoria Station Telegraph Office, the members have saved £75,000 in National Savings Certificates. Savings groups at the British Railways locomotive works at Derby have 764 members, an increase of 25 per cent. in six months. They saved £7,122 in the same period. Altogether there are now 24 savings groups in the Derby works and offices.

A Streamliner of 1865

In an editorial note in our March 7 issue we gave some details of a proposed streamline train patented by the Rev. Samuel R. Calthrop, of Roxbury, Mass., U.S.A. in 1865. With remarkable prophetic sense he anticipated many of the principles which have guided the streamlining of trains within the past twenty years. Calthrop, bearing in mind ship design, considered the train as a vessel where air took the place of water, but with the difference that it was entirely contained within the one element. Our contemporary *La Vie du Rail* published some interesting details of this invention in a recent issue, with an impression showing how Calthrop's train might have appeared, which we reproduce.

Four-Foot Railcar

A nine-month-old calf walked into Arley, Worcs, Station, carrying a diesel railcar on her back—or so it seemed.

Explanation: The calf, straying on the line near Arley, was run over by the car, stood up underneath it and refused to come out. So the car was driven on to Arley with the calf walking underneath. Only damage: the calf had one horn crumpled.—*From the "Daily Herald."*

Writer's Cramp

A book just published by the Stationery Office called "Moving and Growing" explains that a reluctance to answer letters is often due to "the feeling of difficulty and strain associated with the movement involved in holding a pen and writing with it." We are obliged to the Stationery Office for explaining a phenomenon that has often perplexed us. We have always suffered severely from that feeling. If obliged to write a cheque we are frequently bowled over by an acute spasm. Even if required to commit a paragraph to a typewriter we have to fight hard to overcome our aboulia.—*From "The Scotsman."*

Right Away

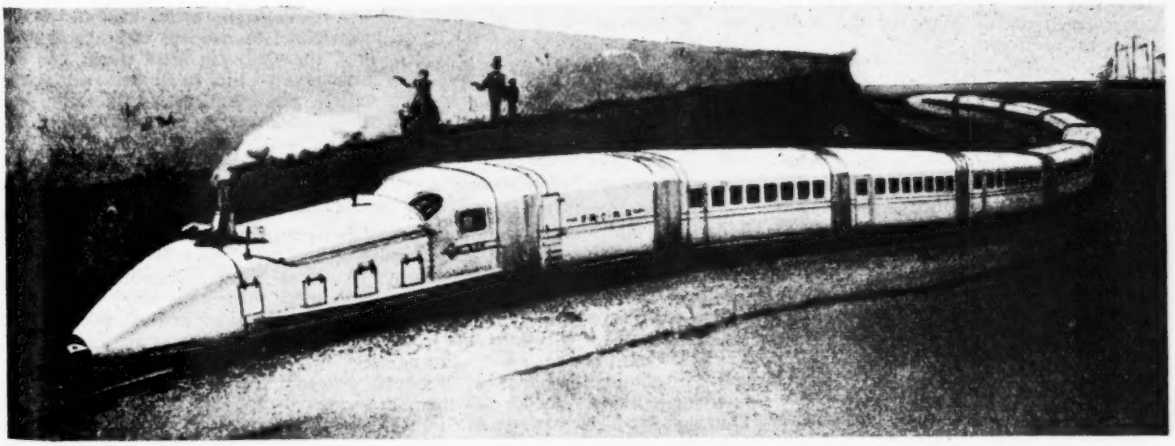
"Join the Navy and see the world," the recruiting posters used to say. Nowadays it seems a much easier method is to join British Railways, for every year a greatly increasing number of railwaymen are taking advantage of the reciprocal Continental free-pass arrangements now in force. . . . The record, perhaps, for distance travelled is held by three young railway clerks who left Liverpool on a recent Friday evening and returned a fortnight the following Sunday. During that time they had travelled to Tangier, Morocco, by way of Dover, Calais, Paris, San Sebastian, Madrid, and Gibraltar. Cost to each in fares was 15s. return boat passage from Gibraltar to Tangier.—*From "The Manchester Guardian."*

Uncontrolled Ablutions

When the Pennsylvania Railroad recently doubled its charges for the use of its toilet facilities, the Office of Price Stabilisation started a suit for a £137,500 fine for contravening the Defence Production Act. The railway claimed that it was exempt from price regulation as a common carrier, and that the Government had no case. The matter was debated by the senate while discussing extension of the Act, and led to the introduction of an amendment, which was accepted, stating that "charges for the use of wash rooms and toilet facilities in terminal stations" were exempt from controls.

Oslo Railway Crossing

Another example of an ungated railway crossing of a main city thoroughfare is quoted by Mr. L. S. Pran, of Oslo referring to the Brisbane crossing illustrated in our May 16 issue. He mentions the fact that the only railway line between Oslo East and Oslo West stations runs right through the city and crosses the Havnegata (Harbour Street), which carries nearly all the southbound road traffic from Oslo. This line, says Mr. Pran, is also the most direct link between the eastern and western sections of the Norwegian Railways, the only other connection being *via* Roa and Hönefoss, which is not well suited to through traffic.



Impression showing the possible appearance of a streamline train patented by an American inventor in 1865

OVERSEAS RAILWAY AFFAIRS

(From our correspondents)

INDIA

Rolling Stock Programme

The Ministry of Railways is to spend about £31,500,000 on its rolling stock programme for the year 1953-54. The amount will be used to buy 245 locomotives, 1,100 coaches and 11,000 wagons and other items including boilers, cranes, and ferries.

The capacity of national sources of supply will be used to the maximum extent in the new programme, which is the third annual phase of rehabilitation of the railways. The remaining items will be obtained from overseas.

PAKISTAN

East Bengal Rail Link

Construction of a line between Jessore and Chalna is under consideration, according to the Chief Traffic Manager of the Eastern Bengal Railway. Referring to the demand for construction of a line between Dacca and Aricha, he said that a project for it had been drawn up but on examination it had been found "financially unjustified."

NEW ZEALAND

Auckland Electrification

The Minister of Railways has said that the committee investigating the electrification of the Auckland suburban railways had no helpful or conclusive recommendations to make in its report to the Government. The Government was therefore still seeking ways of protecting the capital it would invest in the project.

The Minister hoped to have help in answering the problem from Mr. V. A. M. Robertson, Partner in the firm of Sir William Halcrow & Partners, Consulting Engineers, who was on holiday in New Zealand. Some means of ensuring that the railways would be guaranteed a fair share of the traffic had to be found.

UNITED STATES

New "Congressional"

The new trains forming the "Afternoon Congressional" of the Pennsylvania Railroad, described in our May 16 issue, are each made up to eighteen 85-ft. coaches, and cover the 225 miles between New York and Washington in 3 hr. 35 min., with stops at Newark; the North and 30th Street stations in Philadelphia; Wilmington; and Baltimore. Despite the load, each start-to-stop run is timed at over 60 m.p.h., and running speeds of 80 m.p.h. and over are necessary for considerable distances. For some time before the war an "Advance Congressional" ran in the afternoon non-stop from Washington to New York —one of the longest regular non-stop runs scheduled in the U.S.A.—but no longer operates. The "Afternoon Congressionals" leave New York and Washington at 4.30 and 4 p.m. respectively; the new southbound "Morning Congressional," at 6.30 a.m. from New York (taking 3 hr. 50 min.), was previously called the "Legion," and the new northbound "Morning Congressional" (7 a.m. from Washington, to New York in 3 hr. 55 min.) was previously the "Speaker." The two latter stop also at New Brunswick and Trenton.

Boston & Maine "Highliners"

The new RDC-type diesel-hydraulic railcars which are being put into service by the Boston & Maine Railroad are at work over one of the two principal main lines of the company, between Boston and Troy, 190 miles, and White River Junction, Vermont, and Springfield, Mass. The Boston-Troy stopping train schedule taken over by one of the "Highliners" has been cut by 85 min.

Further railcars of the same type went into service between Boston, Concord, Manchester, Nashua, and White River Junction during May, on schedules accelerated by 35 min. The earliest of all B. & M. diesel streamline trains, which entered service in 1933 as the "Flying Yankee," and was later transferred to the Boston-White River Junction line as the "Cheshire," has now taken over the "Minute Man" service, making a double journey daily between Boston and Troy in 4¼ hr. each way, a reduction of 20 min. on the previous time.

CANADA

New C.P.R. Expresses

The Canadian Pacific Railway has introduced a new transcontinental express between Toronto and Vancouver, with a connection at Sudbury from Montreal. Two new named trains, the "Stampeder" and "Eskimo," now run between Calgary and Edmonton, and the "Kootenay Express" runs between Nelson and Vancouver.

SWITZERLAND

Geneva - Milan Service

The connection between Geneva and Milan *via* the Simplon route has been improved since May 18 by the acceleration of one fast train a day each way, reducing the time to five hours, compared with seven to eight hours by other fast trains between the two towns. The acceleration has been brought about by eliminating a number of stops, reducing others (such as that at Lausanne, which is 2 min. in the Geneva - Milan direction, and 3 min. in the reverse), and by increasing to 77 m.p.h. (125 km.p.h.) the speed on sections between Lausanne and Brigue, such as Villeneuve - Bex (11 miles), Vernayaz - Sion - Brigue (52¾ miles), except for a slack between Leuk (18 miles west of Brigue) and Salgesch (three miles further west).

The train from Geneva leaves Cornavin at 6.10 a.m. and is due at Milan Central at 11.10 a.m. In the return direction, Milan is left at 7 p.m., and arrival at Geneva is at midnight. This connection is mainly intended for businessmen wishing to spend a day in Milan and return the same day. The train is composed of lightweight stock, the first use of Federal Railways lightweight coaches outside the country.

FRANCE

S.N.C.F. Coal Tariff

On May 26 S.N.C.F. rates for the conveyance of coal were reduced by 10 per cent. The S.N.C.F. had been asked by the French Government to investigate the possibility of such a reduction in view of the Government wish to keep down the cost of living.

Long-Welded Rails

By the end of 1951, some 60 miles of track on the S.N.C.F. were equipped with rails welded into lengths of between 325 ft. and 875 ft. Lengths of welded rail have been laid in each Region, suitably dispersed so that experience can be obtained of their behaviour in differing traffic and climatic conditions.

The chief sections so equipped are: on the Metz-Strasbourg line near Benestroff; the Paris-Soissons line between Nanteuil-le-Haudouin and Crépy-en-Valois; the Paris-Granville line between Houdan and Dreux; a portion of the Nantes-La Rochelle line around Montaigu, a short portion between Coutras and Périgueux; the Dijon-Ambérieu line near Bourg-en-Bresse, a fairly long portion of the Valence-Grenoble line; and a length on the Tarascon side of the Nimes Viaduct.

These lengths of line include rails laid on concrete sleepers with elastic spikes of the Crapaud R.N. type, and rails secured to timber sleepers with Griffin R.N. elastic spikes; for both, grooved rubber soleplates have been used.

Maritime Station at Port-Vendres

In the presence of Monsieur P. Tissier, President of the S.N.C.F., and Government officials, a new maritime station was recently opened at Port-Vendres in replacement of that damaged during the war.

The new installation covers a total areas of over 3,500 sq. yd., and new sheds, to handle both freight and passenger traffic, have been constructed. In general, freight is handled on the ground floor, and the upper floors are reserved for passengers. It is expected that the port will handle this year 100,000 passengers and 36,000 *tonnes* of freight.

Efficiency of Gas-Turbine Locomotives

The effect of design features on the fuel consumption of units

By J. L. Koffman

THE success of the Parsons steam turbine at the turn of the century gave rise to attempts to replace steam by a working gas which could be produced at reduced cost, *i.e.*, by utilising hot combustion gases as the working fluid. Two main types of gas turbines were developed in course of time, the constant-volume or explosion cycle turbine, and the turbine with constant-pressure combustion. With the first type, the pressure of the working gas is increased by combustion at constant volume, *i.e.*, thermally, while with the constant-pressure turbine, a compressor is used to increase the gas pressure, *i.e.*, mechanically. The unsteady combustion of the explosion-cycle turbine resulted in design and operational disadvantages which impaired the cycle efficiency.

Constant Pressure Turbine

Since the design and operation of the constant-pressure turbine are attractively simple, numerous efforts were made to develop engines of this type. Nevertheless, until a few years ago the success was hampered because the necessary use of high temperatures resulted in great difficulties so far as materials were concerned, which prevented the use of gas temperatures at the desired level This, together with the low compressor efficiencies, retarded development. A significant feature of the cycle is that only the difference between turbine output and the power absorbed by the compressor is available as useful energy, and to increase the former and reduce the latter, the development had to rely on progress in the field of aerodynamics and metallurgy.

In addition it became obvious that good efficiencies of the turbo-machines and high gas temperatures alone were not sufficient to ensure high thermal efficiencies. To achieve the latter it was also necessary to use the heat content of the exhaust gases with the help of heat exchangers which would transfer the heat from exhaust to the air before entering the combustion chamber. Since the heat exchanger must deal with great flow volumes, and ensure good efficiencies at small pressure losses, a considerable amount of development must be faced in this field with particular emphasis on the regenerative (rotary) heat exchangers with which efficiencies of 90 per cent. should be possible as compared with about 75 per cent. for the recuperator (radiator type) heat exchanger, the space requirements being also in favour of the former.

Basic Cycles

The number of basic cycles which can be used for the conversion of heat into energy in an engine are limited. As

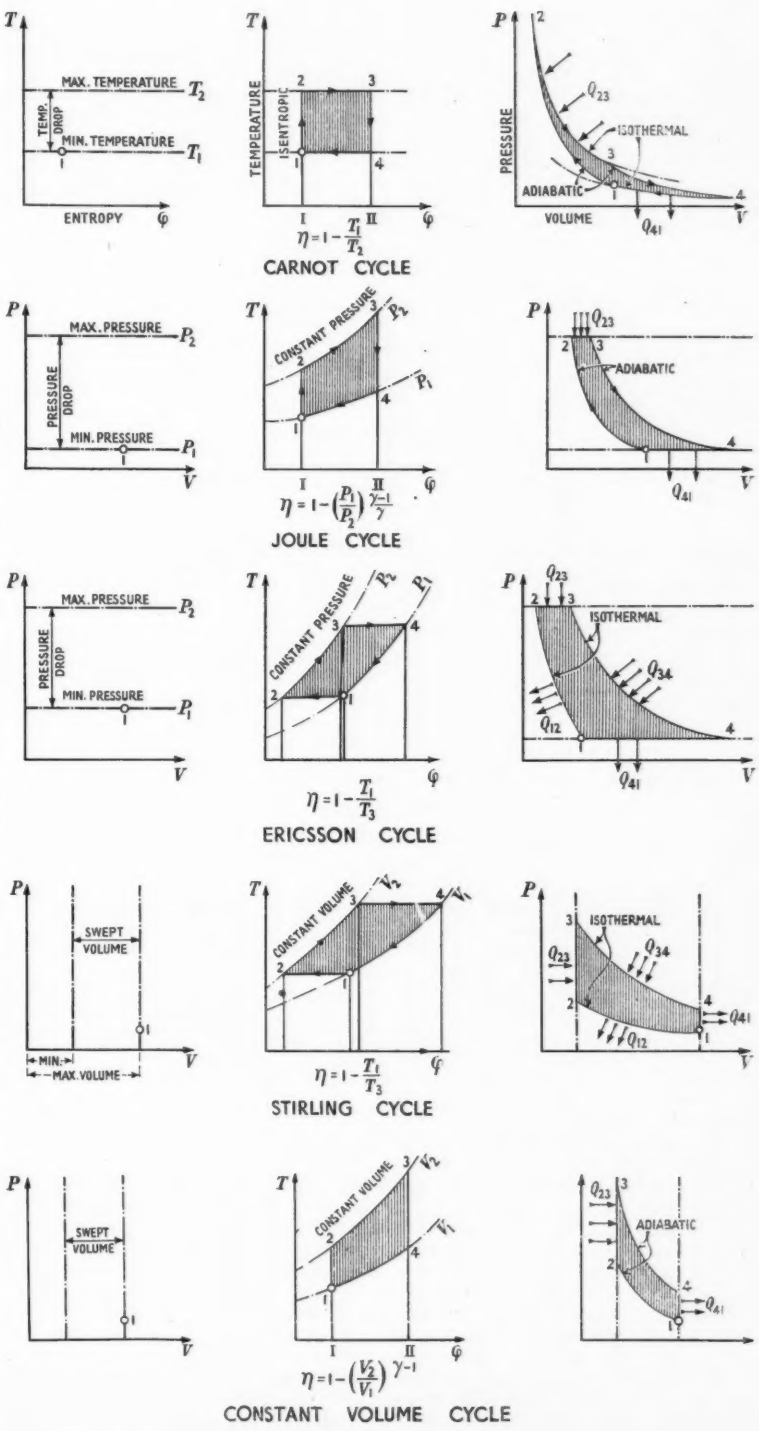


Fig. 1—Thermodynamic cycles

shown in Fig. 1 the ideal process is determined by its own limits and two adiabates. For example:—

1. Temperature limits ; ideal = Carnot cycle
2. Pressure limits ; ideal = Rankine-Clausius cycle
3. Volume limits ; ideal = Constant volume cycle

The gas turbine as at present used with traction applications operates on the Joule (or Brayton) cycle (cycle 2, Fig. 1) which consists of adiabatic compression (1-2) burning at constant pressure (2-3), adiabatic expansion in the turbine (3-4), and heat rejection at constant pressure (4-1). In actual practice the performance will deviate from the ideal cycle since the compression is not 100 per cent. adiabatic; the heating does not occur without a slight pressure loss, and the expansion is not 100 per cent. adiabatic either.

Another two cycles used with heat (hot-air) engines incorporating heat exchangers are due to Stirling (1826) who also parented the regenerator in 1820, and Ericsson (1830). The former is a constant volume cycle with isothermal compression and expansion; with the latter the pressure is kept constant while the working substance passes through the regenerator, *i.e.*, it is independent of the pressure ratio. Both cycles were resurrected in recent times, the Stirling for the Philips hot-air engine, and the Ericsson as the double-isotherm cycle for the Ackeret-Keller (Escher Wyss) close cycle gas turbine.

The overall efficiency of the Ericsson cycle is identical with that of the Carnot cycle, though in practice it is not only the efficiency that matters, but also the amount of machinery required to achieve it. For a given starting pressure, usually slightly below atmospheric, this amount increases with increased maximum pressure, and will be the smaller the more work it is possible to produce per unit volume of aspirated air at a given maximum pressure.

An inspection of the temperature entropy diagrams shows that for the same temperature limits the area of the Ericsson and also the Joule cycle is greater than that of Carnot cycle, *i.e.*, the former result in a better utilisation of the machinery.

However, as against this, the Ericsson cycle requires the use of efficient heat exchangers, and in addition it is scarcely possible to ensure isothermal expansion and compression, although this can be approached by intercooling during compression and by heating in several stages during expansion.

Reverting to the simple gas turbine, its efficiency is given by:—

η = (Heat supplied-heat rejected)/Heat supplied = $[c_p\ (T_3 - T_2) - c_p\ (T_4 - T_1)]/c_p\ (T_3 - T_2)$.

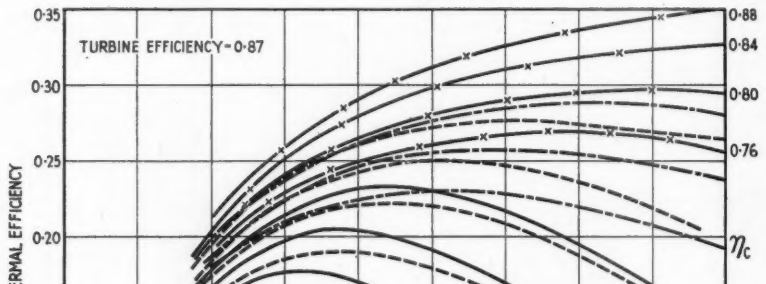


Fig. 2—Effect of temperatures and compressor efficiency on turbine cycle efficiency

For a fixed value of c_p this becomes

$\eta = [(T_3 - T_4) - (T_2 - T_1)]/(T_3 - T_2) =$ (Expansion work-Compression work)/Heat supplied.

Introducing the compressor (η_c) and turbine (η_t) efficiencies and substituting the pressure ratio r for T_2 and T_4 assuming a combustion efficiency of 100 per cent. and constant values of specific heats

$$\eta = \frac{[\eta_t T_3 (r^{(\gamma-1)/\gamma} - 1)/r^{(\gamma-1)/\gamma}] - (T_1/\eta_c)(r^{(\gamma-1)/\gamma} - 1)}{T_3 - T_1\{[(r^{(\gamma-1)/\gamma} - 1)/\eta_c] + 1\}}$$

So far as η_t is concerned, values of up to 0·88 are attainable[1] while η_c values of up to 0·9 have been achieved. In the latter case the efficiency has risen some 15 per cent. in the last ten years. The value of r for axial compressors has risen from about 3 in 1940 to about 6·5 at present. The limitations at present imposed on η are mainly due to the necessity of limiting T_3, the maximum value of which is controlled by the properties of turbine blade materials with regard to strength, creep resistance, and coefficient of expansion. However it should be possible to use higher T_3 values by developing alloys suitable for higher temperature operation, by the development of suitable ceramic materials, particularly for stator blades, and by the development of a practical blade cooling arrangement.

The latter line of attack is at present most attractive, for the use of air-cooled blades would permit the use of substantially higher gas temperatures or, alternatively, the use of cheaper blade materials at substantially identical temperatures. Increased values of T_3 will have the added effect of reducing the specific air requirements, thus allowing the use of smaller compressors and, in turn, reduced fuel consumption when idling.

Locomotive Application

At present the values of T_3 for locomotive applications are in the order of 1,100° F. to 1,400° F., but it appears that with air cooling " there is every likelihood of blade cooling permitting gas temperatures of the order of 600° F. higher than are possible with uncooled blades."[2] The pressure ratios of locomotive gas turbines are in the order of 4 to 6, there being an optimum pressure ratio for each gas temperature. The dependence of the overall efficiency on temperatures and the resultant need for metallurgical development is dealt with fully elsewhere.[3]

To illustrate the effect of gas temperatures and compressor efficiencies on overall thermal efficiency and required pressure ratios at a constant turbine efficiency of 0·87, a number of curves have been plotted in Fig. 2 for a simple gas-turbine cycle assuming equal air and gas mass flow, a combustion efficiency of 0·98, a mechanical efficiency of 0·99, ambient temperature of 60° F. internal losses of about 4 per cent. of absolute compressor delivery pressure, and an exhaust back pressure of 0·2 lb. per sq. in. gauge. A similar evaluation of the effect of turbine efficiency permits the plotting of the curves Fig. 3, showing the effect of η_t and η_c on cycle efficiency.

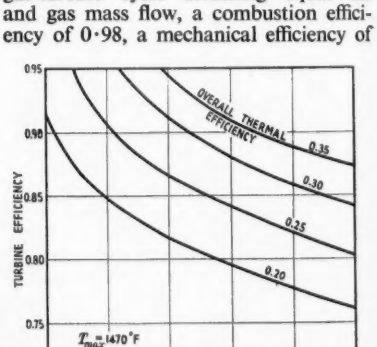


Fig. 3—Effect of compressor and turbine efficiency on turbine cycle efficiency

It will be noted from Fig. 1 that the ideal cycle pre-supposes heat exchange, and it is obvious that the cycle efficiency will be increased if the otherwise wasted

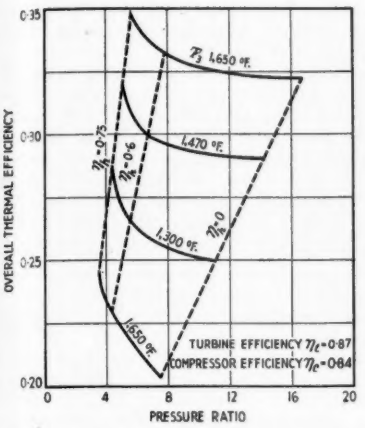


Fig. 4—Effect of heat exchanger efficiency on overall efficiency

exhaust heat is used to pre-heat the air leaving the compressor. Again, to illustrate this point, maximum cycle efficiencies are plotted for $\eta_c = 0{\cdot}84$ and $\eta_t = 0{\cdot}87$ for a number of heat exchanger effectiveness values in Fig. 4. The latter is defined as η_h = rise in air temperature/maximum available temperature difference. The pressure loss due to heat exchanger is assumed to result in a loss of specific power [h.p./(lb. of air) (sec.)] of 5 and 7 per cent. for η_h of 0·6 and 0·75 respectively. It will be noted that the efficiency is appreciably improved at lower pressure ratio, thus improving part load efficiencies. The usefulness of the heat exchanger is reduced as the compressor outlet temperature approaches that of the turbine exhaust.

Determining Fuel Consumption

The various values of thermal efficiency can be used to determine fuel consumption

W_f [lb./h.p. hr.] from: $W_f = 3{,}600 \times 550/778 Q_f \eta$.

With the lower heat content value of the fuel

$Q_f = 18{,}500$ B.Th.U./lb, $W_f = 13{\cdot}75/\eta$ where η in per cent.

The gas-turbine output is sensitive to ambient air temperature T_1 since the power absorbed by the compressor and developed by the turbine is a multiple of the net power obtained at the output flange. This entails that a slight drop in compressor efficiency will noticeably reduce the net power and overall efficiency. This feature might be a considerable disadvantage if a certain output must be maintained at all times, as then the entire power plant must be larger than necessary over possibly the major part of its operating time, a feature which is particularly undesirable with regard to part load performance ; however, as the values of T_3 are increased the effect of T_1 changes become smaller.

The effect of T_1 on power output and efficiency are indicated in Fig. 5 for a simple cycle and T_1 of 1,100, 1,300° F. and 1,800° F. as well as diesel engines.

It is of interest to note that, although the effect of T_1 on the correction factor ϕ is much smaller for diesels, the opinions as to the exact dependence vary. Equation 1 is the familiar correction formula and 2 is the formula adopted by the I.E.C. Equation 3 has recently been published by the M.A.N.[4] Herein N is the power output, f the specific fuel consumption, and η_m the mechanical efficiency of the engine. The factor $\alpha = 0{\cdot}07$ is valid for engines of moderate size and specific speeds. Similarly the gas turbine is also more sensitive to changes of atmospheric pressure than the diesel.

The number of gas turbines running at present or about to start operation is very limited. Their main data is given in the following table:—

GAS-TURBINE LOCOMOTIVES

Owner	Type	Rated output, h.p.	Temp. ° F.	Pressure ratio	Heat exch. efficiency	Turbine, r.p.m.	Compressor efficiency	Turbine efficiency	Thermal efficiency
British Railways ...	CoCo	2,800	1,290	5·2	Not used	7,000	0·85	0·89	0·2÷0·23
British Railways ...	AlA-AlA	2,500	1,110	5·1	0·4	5,800	—	—	—
Swiss Federal Railways	1A-Bo-A1	2,200	—	—	—	5,200	—	—	0·176
Union Pacific ...	BoBoBoBo	4,500	1,400	6·0	Not used	6,700	—	—	0·17
Santa Fe	—	3,750	1,765	3·9	0·5	5,000	0·79	0·88	0·235
Westinghouse ...	BoBoBoBo	4,000	1,355	5·0	Not used	—	0·84	0·86	—
Loco. Dev. Com. of Bituminous Coal Research	2(AlA-AlA)	4,250	1,300	5·0	0·53	5,700	0·84	—	0·23
	2(AlA-AlA)	3,750	1,275	3·93	0·54	6,340	0·79	0·88	0·23

It will be noted that everything about the power plant is—and rightly so, as these are prototypes—moderate, the temperatures, the pressure ratios, the heat exchanger efficiencies, and consequently the overall thermal efficiencies. The efficiency curve of a typical present-day locomotive gas turbine (open cycle) is shown in Fig. 6. This power plant is suitable for use with an electric transmission. Since the determination of part-load performance is complicated,[5] for it requires the knowledge of component performance over a wide range of conditions, only the general relations will be dealt with here.

Fuel Consumption and Speed

The part-load characteristics will be gathered from Figs. 6 and 7. It will be noted that the fuel consumption increases rapidly as the load is reduced, while on the other hand, for a given load the fuel consumption is reduced with the speed. The indicated characteristics are obtained to ensure an optimum performance so far as efficiency and locomotive flexibility is concerned. Maximum temperatures should be maintained if high thermal efficiencies were required at all loads, but this would mean that the turbine speed would depend on the load. Because of the rotational inertia of the

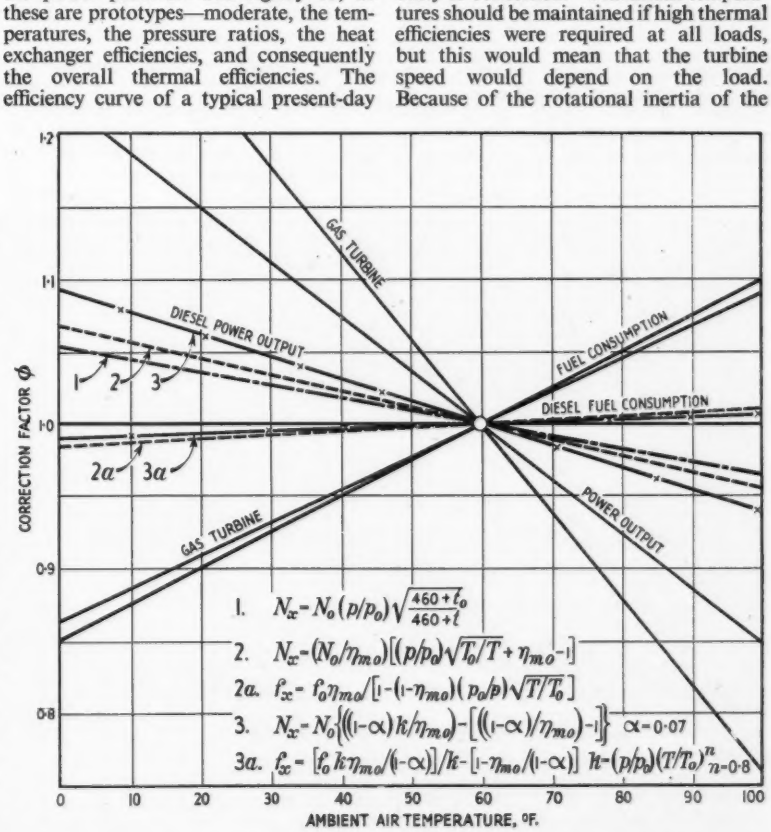


Fig. 5—Effect of ambient efficiency of power output of gas turbines and diesel engines

power plant the adjustment of the requisite output to meet increased load and acceleration requirements would be somewhat sluggish. If flexibility were the overriding consideration, then the set should be kept running at full speed, the power output being regulated by adjusting the temperature. With this type of control the loads can be met rapidly at the expense of part load efficiency.

The fundamental difference between the two methods of control will be of the compressor, combustion chamber, and turbine, with a separate power turbine to drive the vehicle. The power unit can be thermally connected in series or parallel with the compressor turbine and the compressor used for braking.[6]

Transmission Efficiencies

The transmission efficiencies will be substantially identical to those mentioned in the case of diesel locomotives. If mechanical or hydraulic transmissions are used, these may be somewhat simpler, since the torque ratio of a gas-turbine power plant incorporating a separate power turbine can be as high as $M_2/M_1 = 3$ as compared with about 1·13 for traction diesels.*

The specific weight of present-day gas-turbine locomotives appears to have an almost universal value of about 105 lb./h.p. This value compares favourably with about 150 lb./h.p. for diesel locomotives, but is at obvious disadvantages *vis-à-vis* the 60 to 75 lb./h.p. of electric locomotives, though it should be noted that installed power refers to the actual output at the turbine shaft, while in the case of diesels, allowance must be made for auxiliary, losses such as due to fans, air cleaners, exhaust, and so on. On this basis $\eta_{th} = 0{\cdot}2$ of the gas turbine becomes $\eta_{th} = 0{\cdot}2/0{\cdot}9 = 0{\cdot}222$ so far as comparison with diesels is concerned. Thus the overall fuel power to wheels efficiency of gas-turbine locomotives will amount to about $\eta_t = 0{\cdot}2 \times 0{\cdot}9 = 0{\cdot}18$ for mechanical and about $\eta_t = 0{\cdot}2 \times 0{\cdot}8 = 0{\cdot}165$ for hydraulic and electrical transmission, *i.e.*, at the present state of development the ratios of thermal efficiencies for modern steam, electric, diesel, and gas-turbine traction are approximately 1/1·8/2·45/1·5 respectively. But as pointed out previously the drawbar efficiencies are of the order of 1/2·5 to 3/3/2.

With the already attainable value of $\eta_t = 0{\cdot}25$ the ratio of drawbar efficiencies alters to 1/2·5 to 3/3/2·5. That the drawbar efficiency of the gas-turbine locomotive approaches that of other forms of modern motive power is due to its specific weight being lower than that of diesels. In the case of 2,000 h.p. the saving is about 13 tons, and, assuming a rolling resistance of 9 lb./ton, the resultant power loss is about 19 h.p. at 50 m.p.h. Already negotiating an incline of 1 in 100, this loss increases to about 60 h.p.

The now possible increase of thermal efficiency to about 0·25, together with the relatively low weight further reduced by the possible use of a simple mechanical transmission, will make the gas-turbine locomotive attractive on lines where low traffic density will not justify electrification. An additional attraction of the gas-turbine is that in common with the electric locomotive its lubricating oil bill will be low, while with diesels the expenses on this item may come to 5 to 20 per cent. of the fuel costs. In addition —again as with electric traction—it does not require water, although here the air-cooled diesel has already made its appearance, at least for railcar applications.[8]

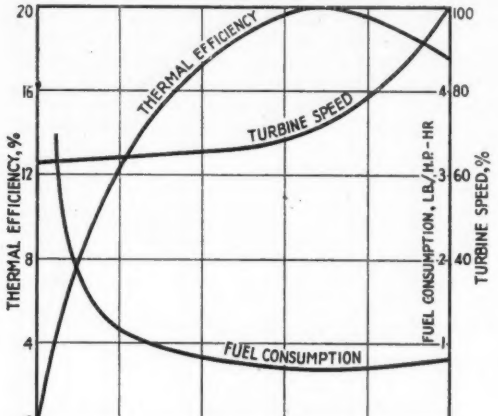


Fig. 6—Efficiency of present-day turbine locomotive

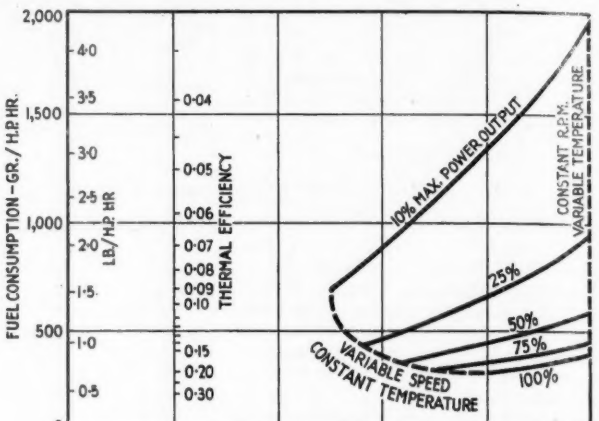


Fig. 7—Part load efficiencies of typical present-day locomotives

gathered from a re-plot of Fig. 7 in terms of the two systems (Fig. 8). The optimum solution would be a compromise between the two possibilities along the lines of Fig. 6. As indicated

Fig. 8—Effect of method of control on part load efficiency

in Fig. 6 the turbine speed rises very slowly until the power output reaches about 60 per cent. of the maximum. From here on the speed rises proportionally with the output. The idling (no load) speed is kept about 60 per cent. of the maximum and with more recent locomotives this speed is further reduced to about 40 per cent. of the maximum. With mechanical transmissions the power plant will have to be divided into two groups, the compressor group, consisting

* The measure of engine flexibility is given by the expression $F = (M_2/M_1)(n_1/n_2)$ where M_2 = Torque at max. output, M_1 = Max. torque, n_1 = Speed at max. power and n_2 = Speed at max. torque (7). For traction diesels F varies between 1.23 and 2.08 with 1.8 as mean value

Conclusions

The picture which thus emerges—as far as thermal efficiency and for that matter also the use of home fuel is concerned—is distinctly in favour of electric traction. Capital outlay will limit its application to lines with a traffic density sufficiently heavy to justify the expenditures involved. On lines with lighter traffic, the diesel locomotive will, for the time being, continue to gain ground, and rightly so, but it will be here that the gas turbine is bound gradually to displace the diesel, as it has many obvious

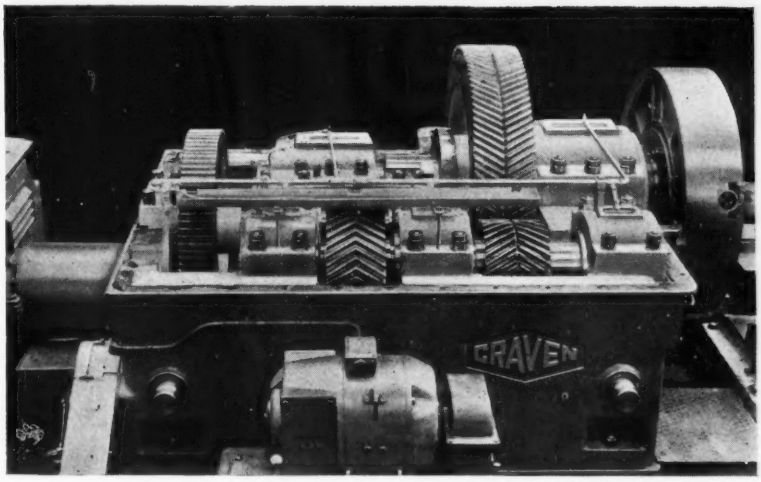
(*Continued on page* 714)

Tyre Billet Slicer

Spindle speed is increased progressively as the cutting diameter decreases

A MACHINE specially designed for slicing steel ingots into slabs for the manufacture, by subsequent blanking and rolling processes, of locomotive and carriage and wagon tyres has recently been designed and built by Craven Brothers (Manchester) Ltd. The machine, two of which have been supplied to Thos. Firth & John Brown Limited, incorporates a device by which spindle speed is progressively increased as the cutting diameter decreases, thus maintaining a constant cutting speed.

The machine is driven by a 100 h.p. variable-speed motor and is capable of slicing steel ingots up to 24 in. diameter and approximately nine feet in length. Up to a maximum of nine parting cuts can be made on the machine simultaneously, using a ⅞-in. wide square-section front parting tool, and a vee-point rear parting tool for each cut. The tools are fed forward to approximately 3½ in. diameter, leaving a vee-section finish at the bottom of the groove; parting of the billets is completed after the ingot is removed from the machine.



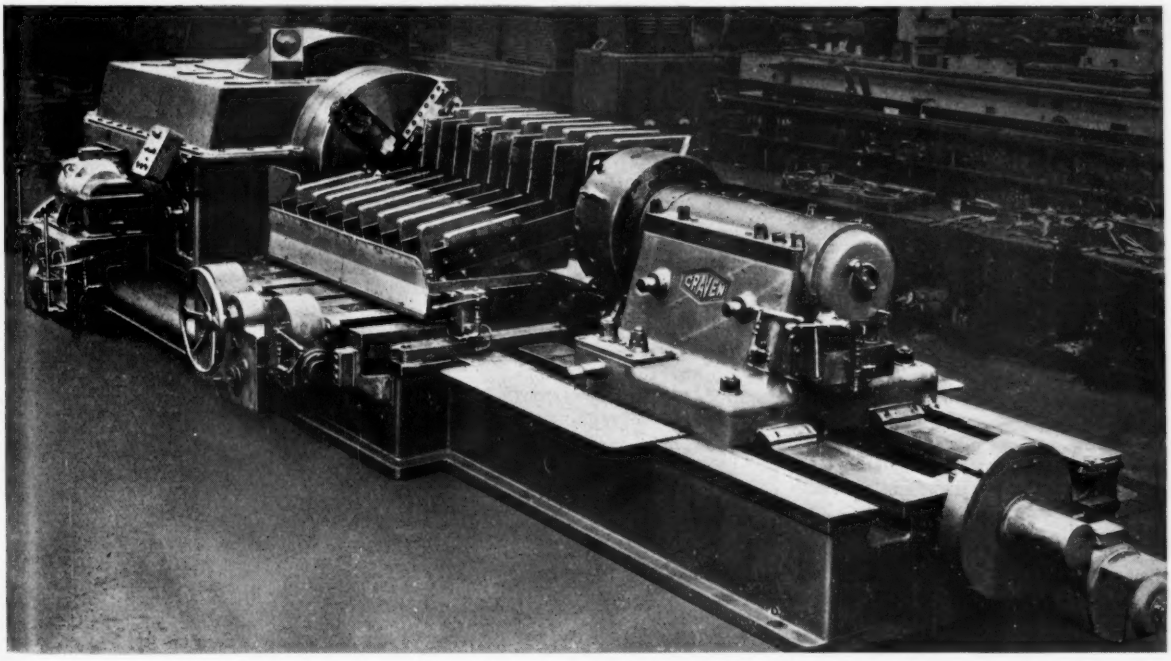
The driving headstock with the cover removed showing the double-helical final drive

Test with 14 in. dia. Ingot

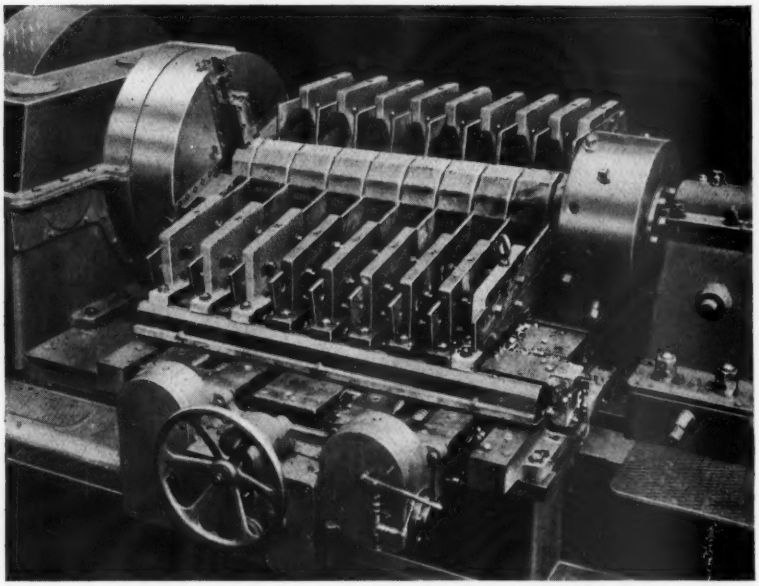
During tests at the maker's works, a 14 in. diameter ingot is reported to have been parted into ten sections in 25 minutes. Eighteen cutting tools were used and the spindle speed was increased progressively from 6½ r.p.m. to 19½ r.p.m. by means of the accelerating device. An initial feed of ·013 in. per revolution of the spindle was employed, and subsequently increased to ·016 in. The maximum current of 240 amp. registered during the test indicated that approximately 60 h.p. of the 100 h.p. available had been absorbed.

The headstock houses all transmission mechanism from the motor input shaft to the high-carbon steel spindle, and includes the primary spur reduction gears and both intermediate and final double-helical driving pinions and wheels. Capped, phosphor-bronze bearings are used for the spindle and intermediate shafts. The high-speed input shaft runs in ball and roller bearings. The spindle is provided with heavy ball thrust washers.

The machine is of the rigid construction necessary for dealing with heavy-duty work. Ingots are cast with a slight taper and it is the normal practice to grip the small end in the headstock chuck, while the thicker end is sup-



The Craven tyre billet slicer showing the setting for 18 parting tools



The machine under test at maker's works using an 18-tool set-up

ported by the heavy tail-stock. The headstock chuck is of cast steel, having independently-adjusted jaws and reversible pads with offset location toggles.

Method of Operation

The tailstock traverse is operated by an independent motor and leadscrew and locked in position by a quick-acting device. A bell-type chuck fitted to the end of the tailstock spindle is arranged with a series of set-screws by means of which ingots up to 22 in. dia. can be gripped effectively without undue overhang of the screws. The spindle revolves in capped phosphor-bronze bearings.

The right-hand end of the main bedplate has four slideways which carry the tailstock. The central portion is increased in width to carry the front and rear cross saddles. Each saddle carries a tool slide 4 ft. 10 in. long, mounted on slideways faced with Nitralloy wearing strips. Removable extensions secured to each end of the tool slides give an additional 11 in. width for accommodating the full quota of 18 toolholders. The extensions are supported on separate Nitralloy-faced supports bolted to the bed and are removed when dealing with exceptionally short ingots. The faces of the tool slides and extensions are provided with tee-slots for securing the individual tool holders in position, the latter being spaced to suit the required width of slabs. The parting tools are secured in the various holders at the appropriate top rake angle. Extension supports are arranged to avoid undue tool overhang. Front and rear tool slides traverse inward simultaneously by means of four transverse feed screws coupled together through balanced worm reduction gear and cross-shaft.

Automatic power feeds from 40 to 80 cuts per in. are derived from a four-change gearbox and shaft. Rapid traverse is through two lever-operated friction clutches inside the gearbox. Control of the main motor and rapid power traverse is by push-buttons conveniently located at the front of the headstock. Power traverse for the tailstock is also controlled by push-buttons on the front saddle.

Automatic Speed Control

The machine is designed for d.c. supply. The design can be modified to incorporate electrically-controlled change-speed gearing for use with a constant-speed a.c. motor. The automatic accelerating device which is a special feature of the machine comprises an electrical speed regulator operated from the transverse travel of the rear tool slide by means of a spring-loaded wire rope and chain mechanism. The regulator is set so that the work speed remains constant at its minimum of 6½ r.p.m. for a given range of high diameter cutting, after which the speed is progressively increased to a maximum of 19½ r.p.m. at a point approaching the smallest cutting diameter, thus maintaining a constant cutting speed.

Efficiency of Gas-Turbine Locomotives

(*Concluded from page* 712)

advantages. At the moment its advance is slowed by a somewhat low efficiency and not altogether favourable part-load characteristic (again from the efficiency point of view).

To make it fully competitive in every respect, further development will be required in the direction of higher temperatures (materials and blade cooling methods), more efficient heat exchangers (probably of the rotary type with efficiencies of up to 90 per cent. at low pressure losses—operation in the laminar flow range), and compressors and turbines capable of effectively handling the resultant pressure and expansion ratios in a single unit, and last but not least the ability to burn coal. These tasks are being vigorously pursued at present and not too many years will pass before a competitive gas-turbine locomotive power plant will be available, particularly since the constant-pressure gas turbine is amenable to a logical, theoretically backed development, yet another feature it shares with electric machines.

Here the locomotive designer will have to play an important part since a successful gas-turbine locomotive should be light, and have good riding qualities, and in this task the theoretical work of Heumann, Boregeaud, and Pflanz should help to produce units worthy of the new prime mover.

It is to be hoped that the development of the gas turbine will follow lines which will not terminate in an electric locomotive carrying its own power house as is the case with modern diesels. As for the diesel engine, its natural field of application will be for passenger and goods railcars and the railbus, which will gain further in importance on lines with light traffic density.

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New Terminal at Hinkle, Union Pacific Railroad

An unusual running shed is a feature of the project, dictated by the construction of a large dam

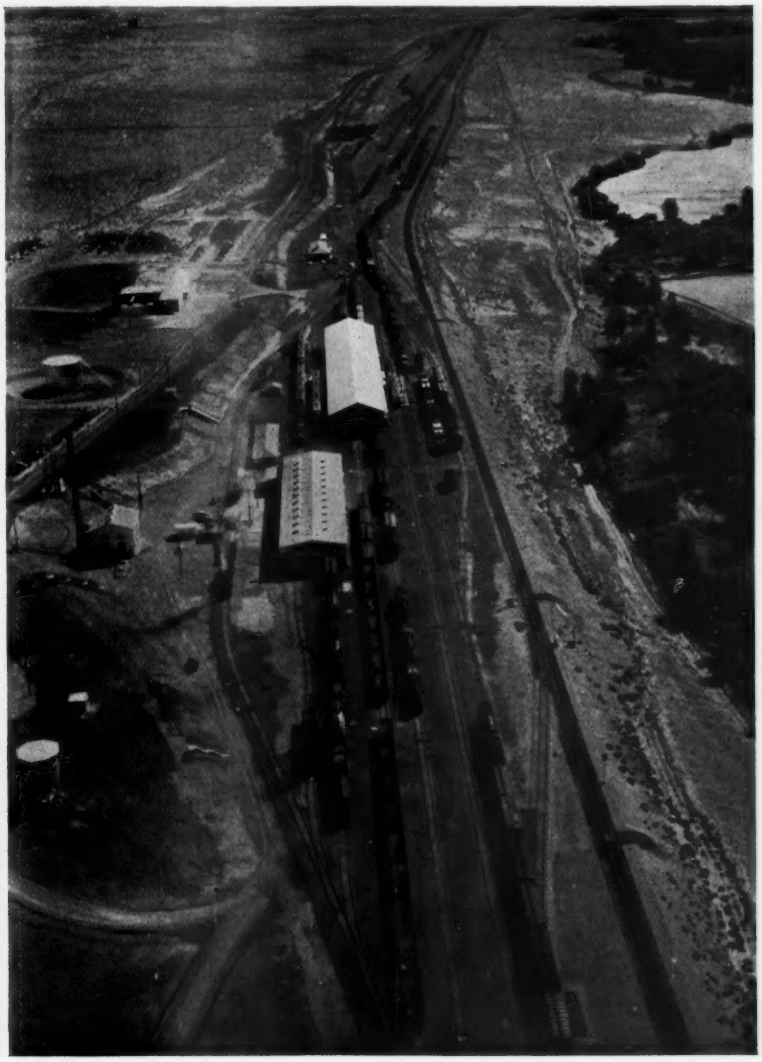
THE construction of the £88,000,000 McNary Dam on the Columbia River, where it separates the states of Washington and Oregon, U.S.A., will form a reservoir stretching for 60 miles up that river, and 10 miles up Snake River. It will inundate considerable sections of railway belonging to the Union Pacific, Northern Pacific, and Spokane Portland & Seattle companies, and the town and freight yard at Wallula.

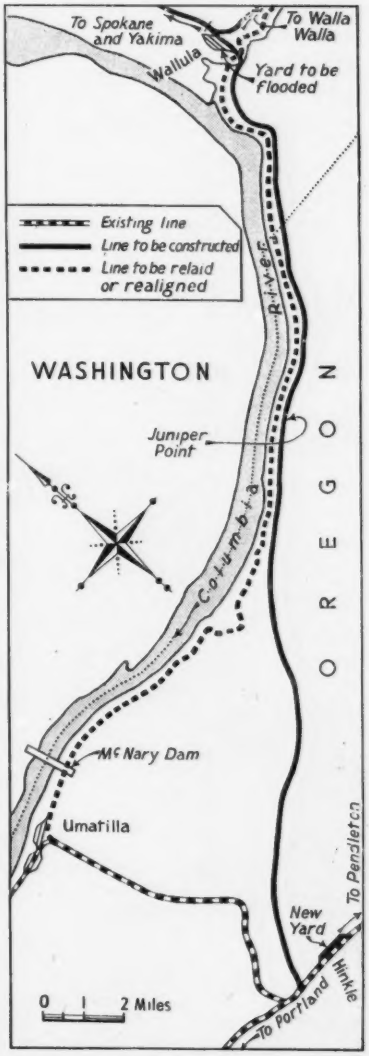
On the Union Pacific Railroad alone, the rebuilding of three lines is involved. In this district there have hitherto been three shunting yards and repair depots—at Rieth, on the Union Pacific main line to Portland; Umatilla, just below the dam; and Wallula. Rather than rebuild the Wallula yard on higher ground, the administration decided to combine the functions of all three yards and facilities in a new terminal at Hinkle, on the main line, and construct a 17-mile new line to connect it with the realigned Wallula-Umatilla section of the Spokane-Portland line at Juniper Point.

The undertaking, which cost $5,000,000, involved the construction at Hinkle of 25 miles of new tracks, in the form of a 1,355-wagon freight grid, auxiliary and stock yards and passenger lines; special icing facilities for the Pacific Fruit Express; and a locomotive depot and repair yard. There is a combined passenger and freight station.

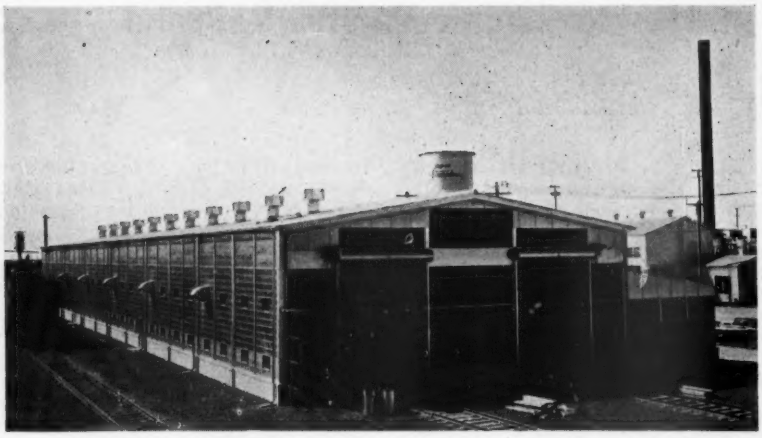
Glass-Walled Running Shed

The running shed for both steam and diesel locomotives is 261 ft. long and 60 ft. wide, has two through tracks, and above the 3-ft. foundation wall its entire walling consists of continuous glass blocks. It is estimated that the greatly improved lighting so secured will justify the extra cost involved by the saving in electric lighting current. The glass blocks, which are easily cleaned with a hose, measure 1 ft. × 1 ft. and are fitted into a 20-bay all-welded struc-





(Left) Aerial view of new yard at Hinkle, U.P.RR., and (right) map of existing and projected lines in relation to the yard



Running shed for steam and diesel locomotives

tural-steel frame. In the south, east, and west walls, the blocks in the three lower courses have high light-diffusion qualities, but those in the upper courses have a higher rate of light transmission. In the north wall, the blocks are of a type which intensifies this transmission. In the partition walls, also of glass blocks, the blocks are decorative. The roof is of Transite corrugated asbestos-cement sheeting.

A special ventilating system has been installed, mainly to dispel diesel exhaust fumes. There are continuous ducts leading up to 22 hoods each containing a 30-in. motor-driven ventilating fan. They are also equipped with motor-controlled dampers to regulate ventilation. With all fans running, the air throughout the shed can be changed in two minutes. The dampers can be opened for gravity ventilation or closed, when the fans are not running.

The shed floor is 18 in. below rail-level, and fixed raised working platforms at cab-floor level are not provided, as major repairs are not done at Hinkle. There are movable platforms, and inside each end of the shed is a concrete apron 14 ft. wide flush with the rails. The inspection pits extend the full length of the tracks, but are only 2 ft. 10 in. deep below rail base. Elaborate heating arrangements are installed. The cost of the shed is put at over £91,000.

An employees' clubhouse provides lodging for train crews in 63 private rooms and nine staff rooms. lounge and dining room. It is a two-storey frame-and-brick structure, and cost some £83,000. The fruit-icing installation handles up to 145 vans, and has a 60-wagon dock for bunker icing. There is also a rip-track shed 430 ft. long covering two tracks, and a diesel locomotive servicing platform.

A Gas Turbine on Goods Traffic

Four gas turbine electric locomotives out of an order for ten have already been delivered from the Erie Works of General Electric (U.S.A.) to the Union Pacific Railroad. One of them is here seen at work on a goods train

Rolling Stock for Egyptian State Railways

Third class passenger and brake coaches and passenger buffet-cars with all-welded underframes

AMONG the rolling stock under construction at the Saltley Works of the Metropolitan-Cammell Carriage & Wagon Co. Ltd. are a number of third class coaches for the Egyptian State Railways. The order comprises 34 third class coaches with brake compartment and 42 third class coaches with buffet compartment. The design of each type is basically similar, other than the arrangement of the interior.

The principal dimensions and other particulars are as follow:—

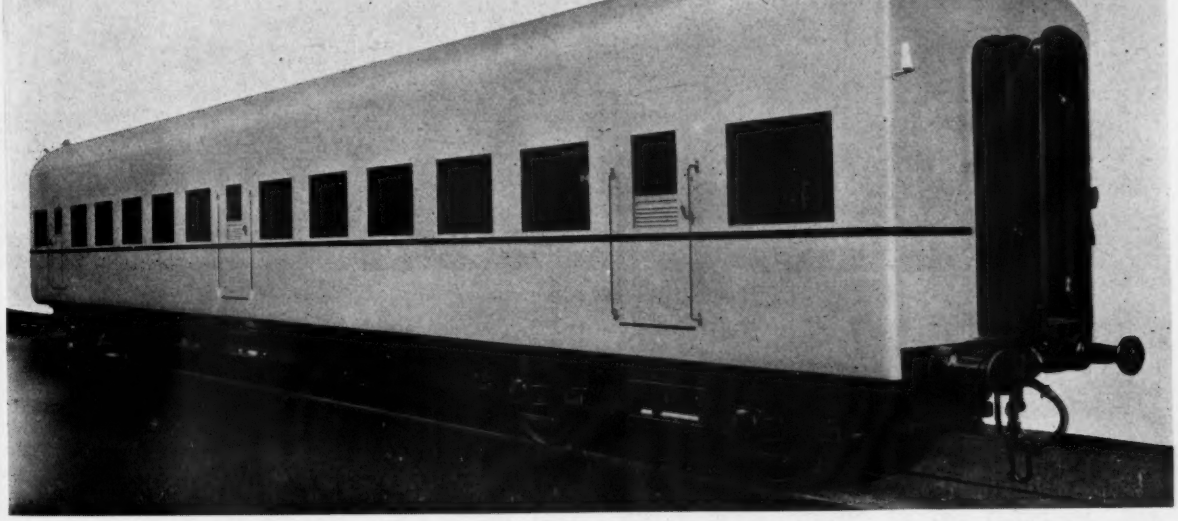
Gauge	4 ft. 8½ in.
Length over headstocks	72 ft.
Width over side panels	9 ft. 6 in.
Height, top of roof to rail level ...	14 ft. 2½ in.
Tare weight of buffet cars	44 tons 15 cwt.
Tare weight of carriages with brake...	45 tons

The bogies of each type of stock are similar and to E.S.R. design and have a wheelbase of 10 ft.; they are 16 ft. over headstocks. Of riveted construction, the bogie solebars are of $\frac{5}{8}$-in. thick mild-steel plate suitably reinforced. The bogie headstocks are of rolled-steel channels 8 in. × 3½ in. × $\frac{3}{8}$ in., secured to the solebars by 6 in. × 6 in. × $\frac{1}{2}$ in. angles, the whole being reinforced by corner gusset-plates. Bolster crossbars are built up from 3 in. × 2½ in. × $\frac{3}{8}$ in. angles and $\frac{5}{16}$ in. plate braced to the solebars with knees and gussets. Further stiffeners are provided between the bogie headstocks and bolsters by 4 in. × 2 in. × $\frac{1}{4}$ in. channel diagonals.

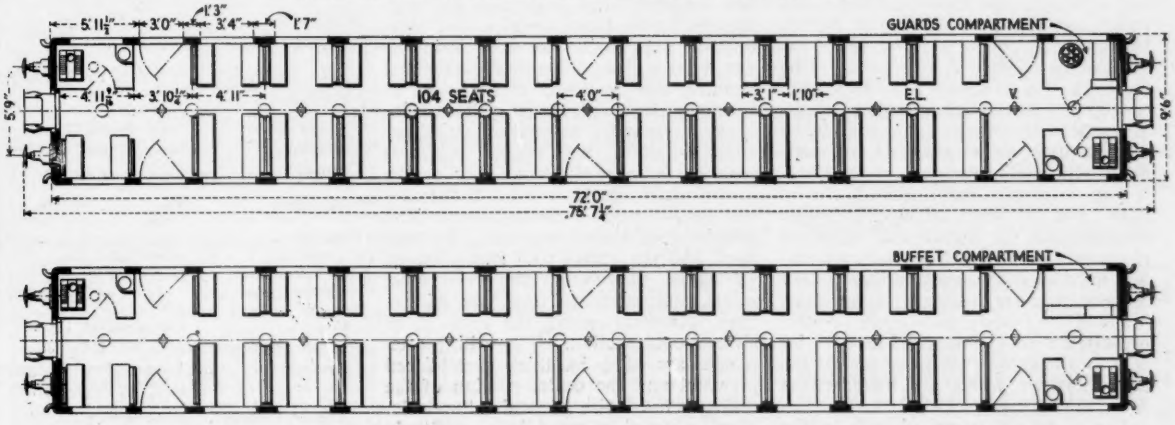
British Timken roller bearing axleboxes are provided and laminated bearing springs are fitted. The bolster springs are of the helical type arranged in nests, and carriage oscillation is controlled by spring-loaded side-bearers attached to the bolster, two placed laterally on each bogie, the top faces of each being covered with Mintex liners.

Underframe Design

The underframes of the brake passenger vehicles and the buffet cars are basically similar and of all-welded construction. The underframe solebars are of 9 in. × 3½ in. channels, reinforced at each corner by 3 in. × 3½ in. angles extending along the solebar for approxi-



Buffet car for the Egyptian State Railways. The third class passenger and brake carriage is similar in exterior appearance and provides accommodation for 104 *passengers*



Plan views showing layout of third class passenger carriages fitted with brake and buffet compartments

mately 12 ft. from the headstocks. Further strengthening is provided by two intermediate longitudinal channels 9 in. × 3½ in. arranged between the bolsters, and two additional diagonals of similar dimensions extending to the underframe headstocks.

The bolsters are built up of mild-steel plates and gussets welded to form a box type of considerable strength. The headstocks are 12 in. × 3½ in. channel sections. Further strengthening is obtained by ½ in. thick top and bottom gusset-plates, together with vertical web-plates at each corner of the underframe, providing additional strength for taking buffing shocks. Transverse bracing consists of 9 in. × 3½ in. channels and 3½ in. × 3 in. × ½ in. angles.

Coach Body Design

The bodies of both the passenger brake vans and the buffet cars are of all-steel construction and of basically similar design. The interior arrangement vary only in that, in the case of the passenger and brake carriages, the buffet compartment is replaced by the brake compartment, and *vice versa*, the dimensions of each compartment being the same. A gangway is arranged between the seats, and passenger communication between carriages when coupled together is provided by vestibules with sliding doors.

Two lavatories are provided, one at each end of the carriage. Ample arrangements for ingress and egress of passengers is provided; the accommodation handles at the centre doorways are recessed into the bodyside; doors open inwards. All body pillars are of steel pressings; " U " section, 3$\frac{33}{32}$ in × 1½ in. × ⅛ in. thick, with the exception of the end doorways which are increased to $\frac{3}{16}$ in. thick.

The body pillars are riveted to the solebars and headstocks and extend to within ½ in. of the bottom face of the underframe members. Additional strength of the body structure is provided by riveting the pillars at solebar level to a 3½ in. × 2½ in. angle running longitudinally along the solebar and secured to it and the body pillars by ⅜ in. dia. rivets. To provide a flush exterior body pillars are joggled at panel joints and at cantrail level.

The body panels are $\frac{3}{32}$ in. thick, secured to the framing by ¼ in. dia. countersunk rivets, the panels being turned under at the bottom to depth of $\frac{7}{16}$ in. The inside area of the bodyside panels is given a coat of red oxide and then sprayed with Limpet asbestos applied with asphalt-emulsion binder. Interior panelling consists mainly of metal-faced plywood, secured in position by aluminium mouldings, while timber furrings are bolted to intermediate pressings the nuts are secured by Thackray spring washers. Alpax louvres and Beclawat balanced windows are fitted.

The seats are upholstered on plywood and supported on angle-iron framing, and the parcel racks are of timber slats on steel supports. The floor is of Induroleum laid on galvanised corrugated sheeting and is coved at the sides to facilitate cleaning. Lavatory fittings include commode, washbasin, drinking-water fountain, and mirror; water is supplied from roof tanks. The design of the roof is identical in the buffet cars and the passenger brake carriages. The exterior roof arch panels are $\frac{3}{32}$ in. mild steel, and the centre roof sheets are of 15 gauge aluminium, the roof sheet joints, aluminium to steel, are laid in zinc chromate paint, the roof is of riveted construction. The ceiling arch panels are of ¼ in. thick metal-faced plywood and the centre portion of the ceiling is lined with ¼ in. thick Sundeala. Noral aluminium mouldings are fitted.

The roof is constructed as a separate unit, and in common with other E.S.R. passenger stock, the space between the outer roof and the ceiling is not sealed at cantrail level, and provides a free movement of air. The roof arch sheets are joined at cantrail level with the body panels by a line of welding, thus providing a flush exterior. Inner and outer carlines are of 1½ in. × 1½ in. × ⅛ in. angles and are secured to cantrail angles 3½ in. × 2½ in. × ¼ in. thick by welding. The roof structure is further reinforced with 5 in. × ⅛ in. mild-steel plates attached to the inner and outer carlines. The inside of the roof sheet and ceiling is insulated by sprayed Limpet asbestos 1 in. thick and ⅜ in. thick, respectively, applied with an asphalt-emulsion binder. Torpedo ventilators are fitted. All stock is vacuum braked and a hand brake is provided in the brake compartment of the passenger and brake stock.

The electrical equipment is by J. Stone & Co. (Deptford) Ltd. Interior lighting is provided by Stone's Duriston No. 22 two-light fittings. The stock is painted in aluminium and a blue line is painted at waist level.

The following is a list of the principal contractors:—

Wheels and axles ...	Taylor Bros. & Co. Ltd.
Axleboxes	British Timken Limited
Springs	English Steel Corporation Limited
I.R. springs	Geo. Spencer, Moulton & Co. Ltd.
Vacuum brake equipment	Consolidated Brake & Engineering Co. Ltd.
Castings	Robert Hyde & Son Ltd.
Lighting	J. Stone & Co. (Deptford) Ltd.
Glass	Pilkington Bros. Ltd.
Gangway diaphragms	A. G. Wild & Co. Ltd.
Plywood	Edmonton Panel Co. Ltd. and Flexo Plywood Industries Limited
A quality Sundeala ...	G. D. Peters & Co. Ltd
Syntholux exterior finishing paint	Docker Brothers

Interior of a third class carriage fitted with buffet compartment, Egyptian State Railways

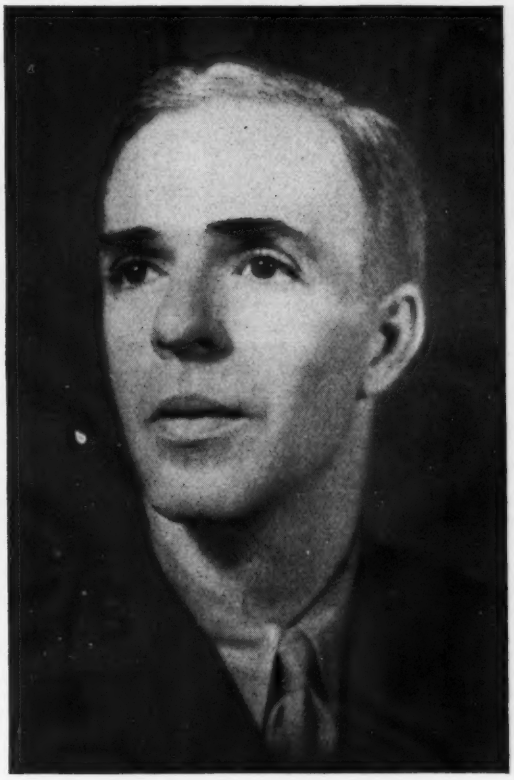
RAILWAY NEWS SECTION

PERSONAL

Mr. John Houlden, Acting Chief Accountant, General Mitre Railway, Argentina, has retired to take up residence in England.

Mr. G. Pande, General Manager, Oudh Tirhut Railway, India, who, as recorded in our May 23 issue, has been appointed General Manager, North Eastern Railway, India, was educated at Muir Central College (Allahabad University), and Roorkee Thomason Civil Engineering College. He was appointed as an apprentice engineer on the East Indian Railway in 1925 and in the following year became Assistant Executive Engineer. Between 1927-28 he was on the Rikhikesh-Karanprayag railway survey and in 1929 became Assistant Executive Engineer, Open Lines. Mr. Pande was appointed Superintendent, Way & Works, Allahabad, Moradabad and Dinapore, in 1940; Personnel Officer (Senior Scale), Asanol and Headquarters Office, in 1942; Executive Engineer, Construction & Doubling, in 1944; and Deputy General Manager (Planning), in 1946. Between 1947-48 he was Joint Director, and later Director, Civil Engineering, Railway Board. In 1948 he was appointed Divisional Superintendent, Dinapore, East Indian Railway, and later in the same year became Engineer-in-Chief, Ganga Bridge, Mokameh. He again served as Director, Civil Engineering, Railway Board, between 1949-50 and in October, 1950, became General Manager, Oudh Tirhut Railway.

Mr. G. Pande
Appointed General Manager, North Eastern Railway, India



Mr. P. G. C. Peyton
Appointed Chief Mechanical Engineer, North Eastern Railway, India

Mr. David D. Frank has been appointed as Director of Information of the American Locomotive Company.

Mr. L. B. Shoppee, who has retired as Signalling Assistant to the Operating Superintendent, Euston, London Midland Region, recently, was presented with a cheque and an autograph book signed by all associated with him at Euston. Mr. H. Vernon, his successor, made the presentation on behalf of the signalling section staff.

We regret to record the death on June 21, at the age of 59, of Colonel W. C. Devereux, C.B.E., Managing Director, Almin Limited.

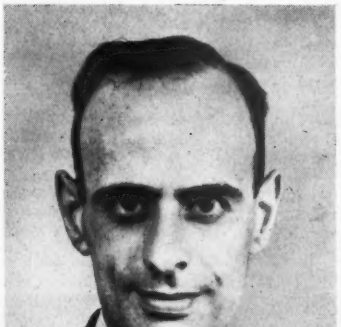
Dr. Frohne, late Secretary to the Minister of Transport; Dr. Schelp, President of the Hamburg Divisional Management, German Federal Railways; Dr. Hilpert, sometime Minister of Finance, Hesse; and Mr. Hatje, of the West German railway trades union, have been nominated by the Minister of Transport, Western Germany, as members of the Federal Railways Committee of Management, with effect from May 21. Dr. Helberg, former Director General, and Dr. Gerteis, Deputy Director General, have relinquished their appointments.

Mr. P. G. C. Peyton, M.I.Loco.E., Chief Mechanical Engineer, Oudh Tirhut Railway, who, as recorded in our May 23 issue, has been appointed Chief Mechanical Engineer, North Eastern Railway, India, served a pupilage with the L.M.S.R., and one of its constituents from 1918 to 1924. He joined the South Indian Railway as Assistant Mechanical Engineer in 1924 and two years later was appointed District Mechanical Engineer. In 1941 he joined the Royal Indian Engineers rising to the rank of Lt.-Colonel and becoming Assistant Director of Transportation Directorate, Baghdad, in charge of Railway Mechanical Engineering. Mr. Peyton returned to duty with the South Indian Railway in 1944 and was promoted to Deputy Chief Mechanical Engineer at Golden Rock, in 1945. Mr. Peyton has acted as Chief Mechanical Engineer, South Indian Railway, from August to October, 1947, and between February and November, 1948. He was appointed Chief Mechanical Engineer, Oudh Tirhut Railway, in February, 1950.

The Ministry of Supply has announced that Mr. Kenneth Gordon has been appointed Director General of Ordnance Factories and will take up his post on July 1. Mr. Gordon, who was appointed Deputy Managing Director of Head Wrightson Processes Limited last November, has been specially released for his new position by Head, Wrightson & Co. Ltd.

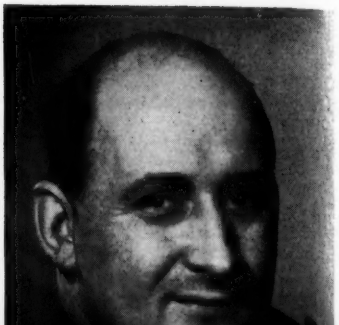
Mr. H. T. Forth

Assistant Chief Accountant, G.W.R. & Western Region, British Railways, 1934-52



Mr. George A. Weeden

Appointed Assistant to Motive Power Superintendent (Mechanical), Southern Region



Mr. J. G. Bruce

Appointed Acting Assistant Mechanical Engineer (Works), London Transport Executive

Mr. H. T. Forth, Assistant Chief Accountant, Western Region, who, as recorded in our June 20 issue, has retired after 45 years service, was born in 1891, and commenced his career in the Chief Accountant's Office of the Great Western Railway at Paddington in 1907. During the 1914-18 war he served with the 15th London Regiment (Civil Service Rifles) in France, Macedonia and Palestine. After experience in various Sections of the Office, he took charge of the department dealing with the accounts of road transport and canals, and in 1925 became Clerk-in-charge of the Engineering, Signal & Electrical Accounts Section. In 1930 he was appointed Assistant to the Chief Accountant and carried out a great deal of special work in connection with various road transport undertakings in which the G.W.R. became financially interested. Mr. Forth was promoted Assistant Chief Accountant in 1934, and has been actively associated with the accounting arrangements during Government control and the changeover due to nationalisation.

Among those due to arrive at Southampton today, June 27, in the United States Lines flagship *America* is Mr. Walter J. Tuohy, President of the Chesapeake & Ohio Railway.

Dr. C. J. Milner, Head of the Physics Section, Research Laboratory, British Thomson-Houston Co. Ltd., Rugby, has been appointed to the Chair of Applied Physics at the New South Wales University of Technology, Sydney, Australia, where he will be taking up duty in October.

Dr. Miguel Revestido, General Manager of the General Belgrano and General Roca Railways, Argentina, has been appointed Minister of Finance in President Peron's Cabinet, and Mr. Octavio S. Vivas, General Manager of the D.F. Sarmiento Railway, has been appointed General Manager of the Buenos Aires Provincial Bank. As a result of these appointments, Mr. Tomás J. Gouk has been designated General Manager of the General Roca Railway, and Mr. Pedro M. Castelli as General Manager of the D.F. Sarmiento Railway.

Mr. George A. Weeden, A.M.I.Mech.E., A.M.I.Loco.E., Assistant District Motive Power Superintendent, Stratford, Eastern Region, who, as recorded in our May 9 issue, has been appointed Assistant to Motive Power Superintendent (Mechanical), Southern Region, was educated at West Ham Municipal College and Queen Mary College (University of London). He joined the L.N.E.R. as a fitter's apprentice at Stratford in 1931 and was awarded a L.N.E.R. Director's full-time scholarship. In 1937 Mr. Weeden was awarded the first locomotive running graduateship for special training in the Mechanical & Electrical Engineer's, Motive Power, and Accountants Departments of the L.N.E.R., and he received further training as a supernumerary running shed foreman at Cambridge in 1939; he was appointed Running (Shift) Foreman, Stratford, in 1942. Mr. Weeden received appointments as Locomotive Shedmaster at South Lynn in 1943; at Stockport & Heaton Mersey, under the closer working arrangements of the L.M.S.R. and L.N.E.R., in 1944; at Eastfield, Glasgow, in 1944; and at Kings Cross in 1947. In 1949 he became Assistant District Motive Power Superintendent, Stratford, Eastern Region.

We regret to record the death on June 18, at the age of 56, of Mr. F. W. Potter, Joint Managing Director of Wyman & Sons Limited.

LONDON MIDLAND REGION STAFF CHANGES

The following staff changes are announced by British Railways, London Midland Region:—

Mr. E. W. H. Powell, District Goods Superintendent, Warrington, to be District Goods Superintendent, Wolverhampton.

Mr. J. W. Edgar, Stationmaster/Goods Agent, Heysham Harbour, to be Assistant District Marine Manager, Heysham Harbour (Reorganisation and position redesignated).

Mr. J. Smith, Assistant to District Operating Superintendent, London (W.) to be Assistant District Operating Superintendent, Liverpool (C.L.).

Mr. R. J. Powell, District Operating Superintendent, Barrow, to be District Operating Superintendent, Derby.

Mr. J. G. Bruce, B.Sc., A.M.I.E.E., A.M.I.Loco.E., Progress & Planning Engineer (Acton Works), London Transport Executive, who, as recorded in our May 30 issue, has been appointed Acting Assistant Mechanical Engineer (Works), is 38. He entered the service of London Transport in 1935 as an engineering trainee and, on completion of his training, was appointed to the technical staff in 1937. He became Section Controller in charge of Northfields Depot in 1940 and was appointed Assistant Production Engineer at Acton Works in 1943 and Production Engineer in January, 1949. As a railway representative nominated by the British Transport Commission, Mr. Bruce visited the United States in 1951 under the auspices of the Economic Co-operation Administration so as to obtain experience of American production methods. On his return he was appointed Progress & Planning Engineer.

Mr. C. N. Montague, Revenue Accountant (Merchandise), Eastern & North Eastern Regions, Newcastle, has been appointed Revenue Accountant (Coaching), Eastern & North Eastern Regions, Marylebone.

Mr. E. V. Winstanley, Chief Engineer, Condenser & Gear Engineering Department, Metropolitan-Vickers Electrical Co. Ltd., has been transferred to the staff of the Chief Mechanical Engineer for special duties and Dr. W. H. Darlington, Assistant Chief Engineer, has been appointed to succeed Mr. Winstanley as Chief Engineer of the Department.

Mr. Frank W. Roberts, for many years a member of the Traction Division of Crompton Parkinson Limited, at Chelmsford, will shortly be joining the staff of the company's Canadian agents, Bepco Canada Limited. He will be Technical Liaison Engineer between Bepco and the Gloucester Railway Carriage & Wagon Co. Ltd., in connection with the supply and entry into service of 104 underground electric railway cars now being built for the Toronto Transportation Commission by the Gloucester company, which has appointed Bepco as its sole Canadian representative for the contract.

Ministry of Transport Accident Report

Near Huntingdon, July 14, 1951; *British Railways, Eastern Region*

Colonel R. J. Walker, Inspecting Officer of Railways, Ministry of Transport, inquired into the fire which broke out at about 5 p.m. on July 14, 1951, in the second coach of the 3.45 p.m. West Riding express, Kings Cross to Leeds, consisting of 14 coaches drawn by class "A.3" 4-6-2 locomotive No. 60058. The flames spread rapidly, but the train was stopped in a short distance. The bodies of the four leading coaches were destroyed. Twenty-two passengers and a guard received burns and other injuries in escaping and nine had to be detained in hospital. Fire-fighting and first aid assistance were speedily obtained. The weather was fine with a light wind. The leading six coaches formed three twin-articulated sets, inseparable at the central bogies.

Course of the Incident

About 4.30 p.m. a woman passenger, sitting where indicated on the accompanying drawing, noticed a wisp of smoke rising between the armrest of the seat and the side of the coach and called attention to it. This led to a man from the restaurant car coming to look. The woman passenger, and a passenger sitting with her, then went to another part of the train. The man, finding no signs of smoke outside the vehicle, reported to the guard, who came and saw smoke issuing between the edge of the carpet and the side of the coach. He assumed it to come from a hot box and decided to throw out a note at Huntingdon for the train to be stopped at Peterborough, 30 min. further on; he then returned to his van. The smoke increased and passengers became uneasy. A man passenger found the carpet hot to the touch and the sponge rubber covering beneath partially melted. He decided to pull the communication chain but found none in the main body of the vehicle and went to the rear vestibule, finally discovering one over an external door. He asked a soldier to call the guard, and advised the other passengers in the coach to move into the coach ahead. He noticed sparks coming from the corner. Fumes and smoke were now much worse and a small flame appeared.

Meanwhile the guard had written his note and tried unsuccessfully to find a potato in the restaurant car with which to weight it but warned of the situation threw the note out. (It was found under the platform coping at Huntingdon the next day). On seeing the flames he went to the leading van and applied the brake fully. The driver had, however, done so, noticing the fall in vacuum caused by the pulling of the chain. The guard obtained an extinquisher, which failed to work, and the flames were now spreading rapidly up the sides and along the coach roof. Passengers had begun trying to escape, but the only available exit was through a single door in the vestibule at the leading end of the first coach and both coaches were full, with persons standing in the vestibule. Dense choking fumes and smoke filled the coaches quickly and it became impossible to see. In the excitement the long, narrow centre corridors in both vehicles became blocked, and some could not leave their seats. Threatened by the rapidly approaching fire there was no alternative for many but to break windows, if they could, and jump out; most injuries from burns and cuts were so caused, although others received burns before they could even make their way out. Fortunately all escaped, for in a short time both vehicles were blazing. The train crew promptly divided the coaches behind the second set and drew the leading four vehicles away and ran the engine clear. The impossibility of uncoupling behind the second coach led to the four being destroyed.

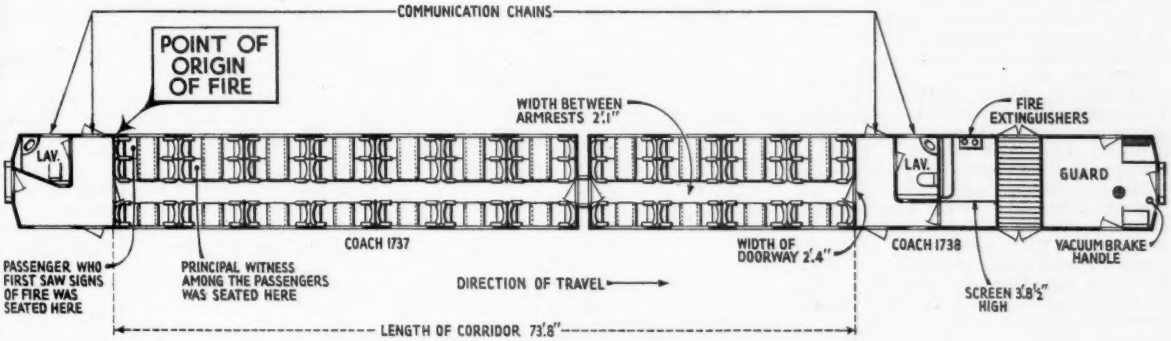
General Bearing of Evidence

Colonel Walker heard a number of witnesses and their evidence can be summarised broadly as follows.

The locomotive was in good condition but had a double fire bar missing from the front drop gate; otherwise all was normal. There was no sign that unusual fire had been thrown out. Possibly the bar had been missing some days, but this could not be definitely ascertained. Nothing unusual was found with the train by any examiner. No signalman saw anything wrong, but the man at Huntingdon North No. 2 box noticed the train stop about a mile in advance and smoke coming from it. He sent emergency messages for fire brigade and ambulances. The driver noticed the vacuum drop when passing that box and stopped as quickly as possible. The smoke from the coaches was very black, but he thought no flames appeared until windows were broken. He had seen no signs of sparks or fire thrown out by his locomotive on the run.

The principal evidence came from the man passenger already mentioned. He proved to be a good, clear witness, although he must have been mistaken about the time elapsing between two of the events involved. His chief actions have been outlined, regarding seeing smoke and finding the chain. He tried to stamp out the fire and again looked at the chain to make sure he had pulled it properly, as the train did not seem to be slowing down. The guard was hampered in reaching his van by the press of people and had to push his way through. At the moment when the train stopped the flames started spreading fast. Soon smoke made it difficult to see and this passenger feared he would be overcome, but reached a window broken by another and threw himself out. Fumes became so bad that they even blew across the track and affected escaped passengers so much that they had to be moved.

Colonel Walker himself summarises the situation thus:—(*a*) The time which elapsed from the first observation of the smoke to the stopping of the train was between 20 minutes and half-an-hour; (*b*) several passengers tried to find the communication chain, but only one succeeded; (*c*) a few described the situation as a panic, but most said that this was not so, although there was a great deal of excitement and rushing about; (*d*) many of the passengers commented on the good work done by the soldiers and sailors who were travelling in the coaches. They said that if it had not been for their help, given at personal risk, some passengers would have been suffocated or burnt to death.



Plan of construction of coaches involved in fire

Construction of the Coaches

The main plan of the construction of the coaches can be seen from the accompanying drawing. The windows were originally double ¼ in. plate with ¼ in. gap between but any replacements had been made as single glass. They could not be opened but had sliding ventilators above them. No paint, cellulose lacquer, french polish, or varnish was used in the interior of the passenger part of the coaches, but the whole, including the roof, was covered with a nitro-cellulose coated fabric, a type of leathercloth commonly known as "Rexine." Seats were upholstered in moquette. The floor was covered with an Axminster carpet, on top of a ½ in. sponge rubber sheet. Woodwork in the vestibules

was finished in french polish. The underframes were steel, and bodywork steel exterior panels with teak framing and soft wood interior linings; partitions and roofs were also of soft wood.

Electricity for pressure ventilation and lighting was provided by a 24 volt 65 amp. generator and two 180 amp./hr. batteries, underneath the frame. The maximum lighting load was 19·3 amps., and for pressure ventilation, 13·5. The batteries were protected on both positive and negative sides by fuses, designed to blow at 165 amps., and carry a continuous current of about 80. Leads consisted of V.I.R. cables, carried on the underframes in corrosion proof conduits, taken to switch and control panels in a cupboard in the vestibule, whence lighting circuits were distributed through three 10 amp. and one 5 amp. fuse. A 24 volt 6 amp. immersion heater in a small boiler provided hot water for the toilet and was separately fused. The pressure ventilation panel contained the control gear, switches, and fuses. The fuses for the blower fan motor circuit were designed to carry 10 amps., and to fuse at 20.

This ventilation was introduced by air ducts under the seats at floor level along each side, with louvres at intervals throughout their length. Close by the last seat at the vestibule end, a branch from the main duct on the left hand side was taken through the floor, along its underside, and up into the toilet compartment, completing the ventilation of the coach.

The floor and covering were elaborate and unusual, and of particular interest. They consisted, from the bottom upwards, of corrugated steel sheeting; ⅛ in. sprayed asbestos; 1¾ in. air space; ¾ in. deal boards; ½ in. hair felt; 1¼ in. deal boards; ½ in. sponge rubber; carpet.

Nothing remained above floor level except the twisted steel panelling and the hoops which had supported the roofs; the communication chain of the second coach had been pulled and the valve was open. The floors were covered with the remains, either completely or partially burnt, of personal belongings, such as suitcases, bags and spectacles, which gave evidence of the haste with which their owners had been forced to escape. There were no signs of burning through the floor itself, except in the corner under the seat where the smoke was first seen. In the original construction, two holes had been made through the floor at this place, one to take the branch air duct for the toilet, and the other to take three electric leads from a thermostat which was fixed to the side of the coach. The fire had evidently been concentrated in the first place in the neighbourhood of the air duct hole, which had been cut in an irregular shape, about 6 in. long by 4½ in. wide. The duct itself was rectangular, 2 in. by 1½ in., and the intention had been that the space between its sides and the edges of the hole should be packed with asbestos; there were, however, no signs of this; the duct simply went through the middle of the hole. On the inside of the coach, the gap was covered by the sponge rubber and carpet, which fitted closely round the duct, so that it could not be seen from above. A considerably larger hole was burned in the lower layer of boarding than in the upper; in the former, it was about 20 in. by 20 in., and in the latter about 14 in. by 13 in.

Although it was to be expected that the lower layer would burn more rapidly than the upper, because more air could reach it, the general appearance of the burning and the shape of the hole gave the impression that the lower layer had been smouldering appreciably longer than the upper.

Inspecting Officer's Conclusion

Colonel Walker considered several possibilities regarding the origin of the outbreak, such as a dropped cigarette, or match, or an electrical fault or short circuit, but concluded that there was little doubt that it had begun with a piece of live coal in the air space between the asbestos and lower wood layer of the floor where the air duct for the toilet passed through, possibly soon after the train left Kings Cross, this wood smouldering for some time before the fire spread through the hair felt to the upper layer. Fanned by the air flow this gradually spread upwards and caused the thin trickle of smoke. Eventually this reached the rubber, and as the rubber was itself covered by the carpet it did not ignite but partially melted and gave off the heavy isoprene fumes noticed before Huntingdon. It burst into flames, however, when the train stopped and came into contact with the leather cloth on the sides of the coach. In a few minutes the fire was out of control.

Remarks

This part of the report is necessarily extensive and its details are of considerable importance. The fire was the third serious one in a passenger train within a little more than two years, and a similar fire occurred in 1941. All four were characterised by extremely rapid spread inside the coaches and difficulties encountered in escaping. This fire raises no points not already indicated in earlier incidents and again emphasises the need for proper and careful consideration of fire hazard in the detailed design of coaches and the great importance of adequate means of escape in emergency, as well as that of giving elementary fire-fighting training to train crews. The following facts stand out clearly: (*a*) the fire would have been prevented if the asbestos packing mentioned had been in place; (*b*) dangerously rapid flame spread would not have occurred had the coach interiors not been covered with highly combustible materials; (*c*) the injuries and graver dangers to the passengers would have been avoided possibly if the fire extinguisher had worked, and a chain been readily available, and certainly had the train crew stopped the train when told of the fire and there had been sufficient doors and windows to allow easy, rapid egress. All these points are discussed in detail in the report.

It is possible that the packing had been missing for some time. The importance of avoiding places where cinders and coal can remain is obvious, but it may be advisable to remind staff of it. At both Huntingdon and Penmanshiel the flames spread up to and along the roof and heat intensity increased remarkably quickly. Passengers some distance from the outbreak received burns before they could escape. The most dangerous feature was that thick black smoke and overpowering fumes filled the coach in which the fire started and spread along the corridors blinding and choking the occupants of other vehicles. Inability to see increased the alarm and hampered orderly escape. Fumes, not flames, are often the cause of deaths in fires and this needs special consideration in trains with their confined spaces and draughts presenting a great danger.

At Penmanshiel the flame spread was due to a clear lacquer containing 68 per cent. of nitro-cellulose and at Huntingdon to a coated cloth containing 28 per cent. Both on test fell within the worst or lowest category of "surface spread of flame" specified by British Standards definition. At Huntingdon the sponge rubber floor covering added to the intensity of the fire, although, covered by a carpet, it did not have an immediate spread effect. Nevertheless, it increased the quantity of heat and fumes. It could be ignited easily at its exposed edge and proved capable of generating quickly much heat. These fires show that such materials are unsuitable for railway coaches.

After Penmanshiel the Railway Executive undertook to remedy the cellulose situation, a greater matter than at first thought. It was not known what, and how many, coaches were affected. All had to be tested. Of the 24,900 corridor coaches, 23,800 had been examined by the time of the report; of them 8,525 contained an inflammable surface and 6,831 had been dealt with, leaving 1,694 to be done and 1,100 to be tested.

The coated cloth situation is different. This was abandoned for passenger stock in 1949 but had been extensively used for many years in certain types of coaches, as well as for blinds, armrests and undersides of removable cushions. Many coaches thus remain affected. Although falling into the same category as the lacquer, its distribution is limited and the risk not so acute. Few, if any, remaining coaches contain the cloth in such large unbroken areas as those on which lacquer was sprayed. Apart from blinds and so on there are approximately 7,000 coaches in which this cloth is used on sides or roofs. Of these 3,320 are affected only from waist level up. Among the remainder the cloth extends down to the floor in 1,220 and 2,460 have metal or other skirting fitted between floor and the bottom of the finish.

The danger spot for starting a fire is on the floor among paper or rubbish, or in corners beside an inflammable surface. With skirtings in suitable places neither of the three recent fires would have broken out. Steps have been taken to fit them to the 1,220 coaches. A number have been completed. Risk of starting an uncontrollable fire from armrests, etc., is negligible, but they would add to subsequent conflagration. Blinds are not likely to become ignited and it would be obvious if one were. Undersides of cushions would burn only with difficulty in most cases. Nevertheless, nitro-cellulose coated cloth is inflammable: the sooner it is removed the better.

The 32 coaches of the type involved at Huntingdon were special, in that their interiors were almost entirely covered with the cloth, left unprotected at floor level. It was later removed from those remaining from waist level downwards, also the sponge rubber. This cloth is being superseded by a superior type coated with polyvinylchloride. If used with the proper adhesive this falls into class 2, low surface flame spread; at present it is more expensive than the other.

Fire Extinguishers

Failure of two of the six extinguishers is most disturbing and should receive earnest attention. Had that which the guard tried worked, passengers possibly would have had time to escape unhurt and the fire would have been held in check. Five, including the two that failed, were of the soda-acid, and one was of the carbontetrachloride type. Dates of last inspec-

tion and cause of failure could not be determined but the guard worked his correctly. It has been decided to adopt the water (gas expelled) type as standard. Existing other stocks are being replaced. Provision of one to each coach, recommended after Beattock, was in hand when the Huntingdon fire occurred. Had there been one in the coach passengers might have been encouraged to take a more positive action themselves and the fire might have been restricted to the hole in the floor.

Communication Chain

The lack of communication chains was particularly unsatisfactory. There were only two at each end of the set, one over an external vestibule door, the other in the toilet, and no notices in the main body of the coach indicating where these were. Such were posted up in similar vehicles after the fire, and chains have since been provided. Passenger communication is required by an Act of 1868 in all trains running more than 20 miles without a stop, the equipment to be approved by the Board of Trade. (This authority now rests with the Ministry of Transport.) There was no vestibule or corridor stock in 1868. A cord was run along outside over the doors. It was necessary to lean out to pull it. With modern stock the chains were provided in each compartment and at intervals in corridors, but gradually the practice grew of reducing the number in certain vehicles, such as dining cars. The trains for which these twin sets were designed were planned to carry an unusually large number of attendants. Presumably this was why the communication facilities were so inadequate. Colonel Walker recommends that the whole question be reviewed to ensure that adequate equipment is provided in all types of stock, approved by the Minister. He concluded that the principal witness was mistaken about the time elapsing—which he first put at 10 min.—between the pulling of the chain and the stopping of the train, and considered that at most it was 4 min., more likely 2½ to 3 min. Tests confirmed this. There seemed no question that the apparatus had acted properly.

Action of Train Staff

Had the attendant and guard taken reasonable precautions at once probably the fire would have been quelled. The former made no attempt to investigate under the seat or put the fire out. The guard's actions, well intended, were particularly ill-judged. Without lifting the carpet he concluded it was a hot box. Had it been, he should not have waited until Peterborough to deal with it. This wasted valuable time and allowed the fire to develop. On the second occasion he acted promptly. Although burned and suffering from shock he continued to assist passengers and carry out his duties. Tests showed that between 17 and 20 min. elapsed between the first intimation of the fire and the guard arriving with the useless extinguisher. No standing instructions were issued to train crews about action in case of fire or suspected fire. If a guard stops an express for reasons found to be trivial or unnecessary, he may be called to account. No doubt the guard, not a regular main line one, was influenced by this. He did not realise the latent dangers of fire.

The report necessarily refers to the recommendations in Colonel Walker's Beattock report and the effect given to them, or otherwise. The Railway Executive was asked to consider a standard fire fighting procedure, so that all staff on a train would know what to do, but thought this impracticable, because of responsibilities in connection with protecting a train. On re-consideration it agreed to introduce the first proposed rule, namely, that if signs of fire are seen or suspected and the source cannot be found quickly or, if found, not easily dealt with, the train must be stopped at once. This would have prevented the casualties at both Beattock and Huntingdon. The Executive remains unwilling to adopt Colonel Walker's recommendation as a whole. His view is that the actual dangers of fire should rank at least as high as protecting a train against potential ones. Main line trains frequently carry a second guard, car attendants, collectors, cleaners, and so on, and they could be made available for closing doors, isolating fumes, stopping draughts, bringing extinguishers, and controlling and helping passengers. Variation of circumstances may make it impossible to devise a rigid drill, but some form of procedure and education of staff in the dangers of fire should not be difficult to arrange and would go a long way to reducing its effects.

Means of Escape from Coaches

An alarming, extremely dangerous situation arose when the fire broke out, but, Colonel Walker considers, it did not amount to panic. Fortunately no young children were involved. The situation was avoidable, for it was caused almost entirely by the general design of the coaches and lack of adequate means of exit. The exact position can be seen from the drawing. All four doors in the corridors opened inwards. A press of people trying to get out might make it impossible to open them, as has indeed been known to happen. When the flames appeared only half of the 42 passengers in the second coach were able to move into the first; the others were forced to break windows and jump out. The same thing happened in the first one, where the 24 passengers were joined by those escaping from the second. In the Beattock report the following occurs, after reference to the desirability of centre doors in sleeping cars:—"... consideration on similar lines should be given to the new open (centre corridor) coach. This is designed to carry as many as 64 passengers, and is provided with two doors at each end. As in the case of sleeping cars, if one end is blocked, there is the possibility, in an emergency, of an uncontrolled rush to escape from the other end. This did, in fact, happen in the same type of coach at Westborough in 1941, and the serious results of that train fire were undoubtedly aggravated by it." The Huntingdon accident has demonstrated the danger arising at Westborough, which the Beattock recommendation was designed to prevent. It was declined by the Railway Executive. A single door was found inadequate for 42 passengers, but the new coach to which the recommendation referred carries 64.

The rejected Beattock recommendations were: some form of organisation among the staff for dealing with fires in trains; additional doors in open (centre corridor) coaches; and an extra door in the corridor of sleeping cars. They were twice referred to the Executive after Huntingdon but found still unacceptable for the reasons that there is no limit to the number of safeguards which can be applied in the search for greater safety; a reasonable balance must be held between incidence of fire and expenditure needed to remove risk of it.

It was thought that acceptance of the following recommendations in the Penmanshiel and Beattock reports would so greatly reduce risk as to make centre doors unnecessary:—(*a*) Nitro-cellulose lacquer to be removed from all coaches; (*b*) surfaces under seats around heaters to be protected by asbestos millboards; (*c*) wire mesh grilles to be fixed under seats, in conjunction with making all seats removable, to reduce the ingress of rubbish and to render it easier to clean underneath; (*d*) gap between seat back and partition to be closed; (*e*) lower portion of compartment partition to be of steel; (*f*) a fire extinguisher to be provided in every corridor coach, dining, sleeping, and kitchen car; (*g*) additional fuses to be provided in the main circuits; (*h*) in sleeping cars, compartment windows to lower sufficiently for passengers to escape. Of these, (*a*) is nearly completed, (*b*), (*c*), (*e*) and (*h*) are for new coaches only, and (*d*), (*f*), and (*g*) are being applied to all coaches as soon as possible.

In open coaches, the objections to centre doors were a loss of seating capacity and amenity. In addition, the risk of fire starting and remaining unobserved in an open coach was thought very small.

Colonel Walker agrees that the question of acceptable accident risk is one of proportion, balancing degree of risk against cost of removing it, but thinks there is no room for nice calculation with fire. The factor of incidence, though important, can be given too much weight, considered alone.

Recommendations already accepted go a long way to reduce risk but danger is not entirely removed. While coaches contain inflammable material the risks remain. The number of fires reported to the Ministry of Transport during the past three years averaged 87 a year, excluding an average of 34 gangway fires. Most caused little harm but each was potentially serious. This cannot be regarded with complacency nor, Colonel Walker thinks, can incidence of fires be considered small, as they represent about 10 per cent. of all train accidents.

As regards cost, he points out that the Executive has incurred considerable expenditure in testing coaches, removing inflammable surfaces and improving extinguishers. He confined his recommendation about extra doors to new stock, with this circumstance in mind. Costs, he understood, would in that case be relatively negligible, with an important gain in safety. The small overall costs would be spread over a number of years and, against risks, cannot be considered prohibitive. It is a different problem to provide new doors in 4,700 centre corridor and 383 sleeping cars. The open centre corridor car of the type recommended already exists, in the latest design of the former Southern Railway, and seats 64, giving no less seating capacity compared with the British standard coach without centre door.

Since the Beattock report an improvement has been made in sleeping cars by making the windows open sufficiently for occupants to climb through.

Summing up, Colonel Walker states that he cannot consider the Railway Executive's reasons regarding risk, incidence, cost, and so on, sufficient to justify refusal to carry out the few remaining improvements.

The railway authorities admittedly give constant thought and care to safety and their vigilance over many years has resulted in the present high general standard. Nevertheless, consideration of the recent fires seems to indicate that awareness of risk has become less acute than it should be.

Parliamentary Notes

Passenger Fares

The Minister of Transport (Mr. A. T. Lennox-Boyd) stated in answer to questions in the House of Commons, on June 23, that until the present fares standstill period outside the London Area ended on September 1; certain British Railways season ticket holders would receive a concession. From May 1, season tickets were limited to three months. Those who before May 1 held season tickets for a period of more than three months would pay a special rate; three-monthly tickets would be charged at "the three-monthly rate or at one quarter of the annual rate, whichever is the less."

The estimated extra revenue from fare increases within the London Area, said Mr. Lennox-Boyd, would be £11½ million in a full year. Had the adjustments coming into effect on August 31, 1952, been in force from March 2, the reduction in income would have amounted to £600,000.

The final effect of changes outside the London Area, he added, was estimated to yield a total additional revenue of £4 million in a full year.

When it was suggested that London was bearing a disproportionate share of the burden, Mr. Lennox-Boyd said that he was ready to receive representatives from the London Passengers Association; there was no case for a general inquiry.

Contribution to Central Charges

This year, Mr. Lennox-Boyd stated, while receipts from railway and road passenger traffic within the London Area would meet working expenses, they would fall short by £6 million of their proper contribution to central charges, reserves, and past deficiencies. Outside London, passenger receipts would meet passenger working expenses and leave about £7½ million a year towards expenses common to both passenger and goods traffic, amounting to about £70 million a year. The B.T.C. was satisfied that £7½ million a year was substantially less than would be an appropriate contribution. Nor did passenger receipts contribute towards central charges, reserves, and liquidation of past deficiencies, for all of which a further £40-£50 million was needed.

Railway Pensions

Mr. Lennox-Boyd said in the House of Commons on June 18, in reply to representations by Major Sydney Markham (Buckingham—C.) and other Members on behalf of railway pensioners, that the B.T.C. had inherited from the railway companies obligations to continue the employers' payments; to maintain the guaranteed interest on money held in the funds; and by deficiency grants to enable guaranteed payments to be made.

The last, he went on, had cost the railways £4½ million in 1951. On nationalisation, all the railway companies' schemes were virtually actuarily insolvent. Last year, 75 per cent. of railway pensions had been paid by the Commission, and that proportion would rise.

Some railway pensioners, Mr. Lennox-Boyd continued, would be getting more than civil servants and some others who did not obtain the full advantages of the Pensions (Increase) Bill less, and most would be getting less than the National Insurance retirement pensions, which the Government intended to raise on October 1. Increases in pensions of up to the value of £450 had been given under past acts and under the Bill would be given up to £550, while for the railwaymen there had been no increase whatever for anyone getting more than £120 a year. He hoped that the worst cases were dealt with in 1944, when those whose pensions dated from before the 1923 amalgamation, and who were not previously entitled to the minimum benefits, were thereby entitled, but many hardships remained.

The suggestion that pensions be tied to National Insurance rates would not meet all needs, as the single pensioner, for example, was getting more as a railwayman that he would under this Bill or under National Insurance. He hoped it might be possible for the B.T.C to find some means whereby the hardest cases could be dealt with.

Fire Precautions in Trains

Lord Lucas, moving for papers on the Huntingdon train fire report, in the House of Lords on June 18, asked whether, in view of the inspecting officer's report on the fire, there should be some change in the law or some arrangement made to give some Minister authority over fire precautions and fire accidents in trains.

Lord Leathers (Secretary of State for the Co-ordination of Transport, Fuel & Power), replying, said that end-door coaches had been replacing those with many external doors, as being more comfortable, and new decorative materials had been much used because of their superior finish.

The four passenger train fires in the last three years, resulting in five deaths and thirty injuries, had all certain features—the rapid spread of flames and the even more rapid spread of thick black smoke and fumes. Three things were demanded: (1) the use for interior decoration of material of low combustibility, (2) extra emergency exists, and (3) a standard procedure for dealing with fires.

Energetic action, stated Lord Leathers, had been taken by the Railway Executive and of its 25,000 corridor coaches nearly 24,000 had been examined. Those found to contain inflammable surfaces were being dealt with as rapidly as possible. In general, no highly inflammable interior finish would be used in any new coaches, "and we may fairly regard the progress made as satisfactory."

There had been differences of view between the Railway Executive and the inspecting officers over additional means of exit and fire-fighting procedure. The Minister of Transport and he himself had had discussions with the B.T.C. and with the Chairman of the Railway Executive on fire precautions.

Centre Doors

A centre door on the corridor side would be provided in all new sleeping cars, all of which would be of steel, the only inflammable elements in the berths being the bedding and carpets. The window opening in each sleeping compartment would provide an emergency exit. The Executive had agreed to fit emergency centre doors on new centre-corridor coaches.

Because of the smallness of train crews and the changing duties of individual members, it was hard to evolve a settled fire drill, but arrangements had been made for the Regional fire officers and their fire inspectors to instruct all trainmen in the operation of portable fire extinguishers. An instruction had been issued by the Railway and Hotels Executives to all staff employed in moving trains, detailing the action to be taken if any man became aware of a fire. On appointment to the train staff, a man would be examined in the rule dealing with fires.

The statement he had just made, Lord Leathers went on, showed that there was no necessity for the Government to intervene directly to enforce the inspectors' recommendation. Great value was attached to the voluntary co-operation between the railways and the inspecting officers.

"It is because serious accidents are so rare on our railways," he added, "that they inevitably attract so much attention. Their record and general standard of safety is unsurpassed anywhere in the world."

The motion for papers was withdrawn.

Staff & Labour Matters

Railway Wages

The Railway Executive at a meeting on June 23, with representatives of the N.U.R., A.S.L.E.F., and T.S.S.A., declined the unions' claim for a 10 per cent. increase in pay and for enhanced payment for time worked between noon and midnight on Saturdays.

The union representatives intimated their intention of referring the matter to the next stage of the negotiating machinery, the Railway Staff National Council. Failure to reach agreement at the Council would most likely involve reference to the highest stage of the machinery, the Railway Staff National Tribunal.

The claim of the employees' side of the Railway Shopmen's National Council for a substantial increase in pay for railway workshop staff is to be considered at a meeting of that body on July 30.

Busmen's Wage Claim

A claim for a substantial pay increase for employees of municipally owned bus and tram undertakings was submitted at a meeting on June 19 of the National Joint Industrial Council for the road passenger industry. It is sponsored by the Transport & General Workers' Union and the General & Municipal Workers' Union, and after hearing the claim, which is based on the cost of living, the employers' side of the Joint Council stated that its reply would be given at a further meeting.

A similar claim on behalf of London bus, tram, and trolleybus workers was submitted to the London Transport Executive on June 20. The meeting adjourned to enable the London Transport Executive to consider its reply.

New Irish Railwaymen's Union

At a conference in Dublin on June 4, attended by 89 delegates from north and south, the 8,000 members of the National Union of Railwaymen formed their own union under the name of the National Association of Transport Employees. Mr. W. T. Chapman, of Cork, has been elected General Secretary. The Executive Committee of the Association will consist of nine members—five from the Republic and four from Northern Ireland. On January 1, 1953, the association will take over.

Road Haulage Wages in Northern Ireland

The Road Haulage Wages Council (Northern Ireland) has decided to give notice of its intention to submit to the Ministry of Labour & National Insurance proposals for minimum remuneration and holidays with pay for road haulage workers. Notices of the detailed proposals are to be sent to all employers in the trade and a period of one month allowed for written representations to the Council.

Permanent Way Institution

Summer Convention in East Anglia

The annual summer convention of the Permanent Way Institution was held at Ipswich from June 14 to 19, under the Presidency of Lt.-Colonel H. B. Everard, Chief Officer, Engineering (Maintenance), the Railway Executive. Some 300 members and their ladies attended, and by facilities accorded by the Railway Executive 40 representatives from the engineering department of the Netherlands Railways were able to participate.

At the General Meeting in the Town Hall, Ipswich, on Saturday, June 14, the members were officially welcomed by the Mayor, Alderman James Chalmers, J.P.

Mr. H. Janes, Honorary Secretary, read the report on the activities of the Institution during the past half year, which showed that all sections had maintained their progress. The Rhodesia Section, formed in 1951, now had 167 members, and sub-sections had been set up at Bulawayo and Gwelo. The number of additional members elected since the last general meeting totalled 300, made up of 16 fellows, 40 associate fellows, 30 members, 208 associate members, and six students.

A supplement to the text book "British Railway Track" had been published. This supplement dealt with British Railways standard flat bottom track, and to date over 2,000 copies had been sold. The publication costs of the *Journal & Report of Proceedings* continued to rise, and it had become necessary to adopt an abbreviated style for section reports, and to increase the charge for advertisements.

Mr. F. Lawson, Honorary Treasurer, in presenting the statement of accounts for the year 1951, said that a surplus of £186 was made on the year's working, but the unit cost per member during the past year had increased by eightpence over the 1950 figure.

At the invitation of the South Wales Section it was agreed that the 1953 convention should be held at Cardiff in June.

After routine business had been dealt with, Mr. E. J. Booty gave a talk on "Ipswich—its history and development." He said the town had a history dating back over 1,000 years, for there is a record of its having been plundered and burnt by Danes in A.D. 893. The town received its first charter from King John in the year 1199. A vote of thanks to Mr. Booty was proposed by Mr. J. Cunningham, Vice-President for Wales.

Later, the annual summer dinner took place in the Co-operative Society Café Lt.-Colonel Everard presided, and among the guests were the Lord Mayor and Lady Mayoress of Norwich; the Mayor and Mayoress of Ipswich; Deputy Mayor and Mayoress of Ipswich, Mr. and Mrs. E. J. Booty; Mr. and Mrs. J. L. A. Cuperus, Mr. and Mrs. W. H. Edmonds, Mr. and Mrs. W. G. Spall, and Mr. and Mrs. J. R. Rowbottom.

Mr. W. Paterson, Vice-President for Scotland, proposed the toast of "East Anglia." The Lord Mayor of Norwich, Alderman W. E. Walker, replied. East Anglia, he said, had many things in common with the Netherlands and he was delighted that Dutch railwaymen were present.

Proposing "Our Dutch Visitors," Colonel Everard recalled the institution's successful gathering at the Hague last year and said how glad they were that it had been found possible for some of the Dutch railway officials and their ladies to be present with them in East Anglia. Mr. J. L. A. Cuperus, Head of the Way & Works Department, Netherlands Railways, responded.

The toast of "The Guests" was proposed by Mr. A. G. Blowers, member of the East Anglia Section, P.W.I., and replied to by the Mayor of Ipswich, Alderman James Chalmers, J.P. Among those present at the dinner were:—

Mr. G. D. S. Alley, Lt.-Colonel D. R. Bennett, Messrs. A. G. Blowers, R. Bradford, P. C. M. Breedveld, G. van Busschbach, W. Bygott, D. P. Carr, T. A. Carson, C. J. Chaplin, J. Cunningham, J. F. Deenik, H. C. Dickin, B. C. Drummond, W. G. Dunstan, A. W. M. Dyke, J. W. van Eden, Lt.-Colonel R. H. Edwards, Messrs. F. G. Edwards, J. Hyde ffolliott, W. J. Ford, M. A. K. Fraser, H. H. Graven, H. Green, S. T. S. Harman, J. M. Hauer, H. Hodgson, L. G. Hoogenboom, J. L. Hoorweg, H. Janes, J. D. Johns, A. P. Kok, C. D. Koning, R. E. Lawler, F. Lawson, S. A. Lethbridge, J. Lohmann, A. C. Maber, H. V. G. Malings, B. L. Middleton, R. C. Mosedale, H. H. Mulder, W. Oosterbaan, H. Ormiston, C. Ouwersloot, W. Paterson, Lt.-Colonel J. N. Peck, Messrs. A. M. Plumer, C. G. Reddington, H. A. W. Reitjens, H. de Rooy, D. D. Shaw, M. G. R. Smith, S. A. Strange, H. E. Thompson, D. C. Treacher, G. J. Tromp, J. A. R. Turner, E. H. Tustain, P. Veenenbos, J. Visser, C. A. A. van der Voet, J. F. de Vries, F. Wensley, O. M. Williams, A. Wynn Williams.

Programme of Visits

On June 15, a party inspected the Civil Engineer's Depot at London Road, also the permanent way layout at East Suffolk Junction; in the afternoon there was a coach tour of the Essex-Suffolk border country. Next day, parties paid visits to the Ipswich works of Ransomes, Sims & Jefferies Limited, and Cranes Limited. The B.E.A. Cliff Quay Generating Station was inspected, while others saw British Railways films and lantern slides of the Institution's 1951 convention in Holland. The evening was spent in a steamer trip down the River Orwell as far as Harwich.

On June 17 the whole party visited Norwich, where members either paid visits to local works or made a tour of the city. The Lord Mayor of Norwich attended a luncheon with the party at Samson & Hercules House, after which all proceeded to Wroxham by coach for a trip on the Broads.

On June 18, morning visits were made to the works of B. X. Plastics Limited, at Brantham, and Edme Limited, at Mistley. The Mayor of Colchester, Councillor Wm. C. Lee, himself a local railwayman, welcomed the visitors at luncheon in the Moot Hall. During the afternoon visits were arranged to the works of Davey Paxman Limited, Mason & Sons Limited, and Woods of Colchester Limited. Later, parties were shown over the museum housed in the castle.

The final day of the convention, June 19, was spent at Lowestoft, and members inspected the British Railways sleeper depot, concrete works, etc. On this day the Dutch contingent, accompanied by the President and officials of the Institution travelled to London, where they spent the day. After a short visit to shopping centres, lunch was provided in the Oak Room at the Railway Executive headquarters, Marylebone. Lt.-Colonel H. B. Everard presided, and among those present were Messrs. J. C. L. Train, Member, Railway Executive, J. Taylor Thompson, Civil Engineer, L.M.R., and M. G. R. Smith, Civil Engineer, Western Region. On behalf of the Institution Colonel Everard expressed the pleasure it had given that Dutch engineers had been able to take part in the convention. Mr. J. Lohmann expressed the visitors' thanks for the welcome extended to them and said they all had enjoyed their visit to England.

A tour round London was then made by coach. The party left Liverpool Street by the "Hook Continental," for the return to Holland by the British Railways steamer *Arnhem* from Parkeston Quay.

Institution of Civil Engineers Conversazione

A conversazione was held at the Institution of Civil Engineers, Great George Street, London, S.W.1, on June 19. A number of exhibits of engineering models and scientific apparatus was on view, including a working model of the Ransomes & Rapier Limited walking dragline supplied to Stewarts and Lloyds Limited; the Brassey Shield, presented in 1851 to Thomas Brassey, the noted contractor, by the promoters of the Great Northern Railway; and a mechanical siever for laboratory test sieves and a wind velocity measurement apparatus. The last-mentioned were exhibited by Mr. M. G. R. Smith, Civil Engineer, Western Region; the wind velocity recorder was referred to in an article in our May 9 issue.

The guests who accepted invitations to attend the conversazione included:—

Mr. W. K. Brasher; Dr. E. C. Bullard; Sir George Burt; Sir John Calder; Captain H. Leighton Davies; Sir Harold Downie; Sir John Hacking; Sir Reginald Hill; Sir Charles Jeffries; Lord Latham; Sir Thomas Lloyd; Mr. V. K. Krishna Menon; Sir Hilton Poynton; Sir Allan Rae Smith; Sir Frank Smith; Mr. A. B. B. Valentine; Sir Bruce White.

Contracts & Tenders

The Ulster Transport Authority has placed a contract with the Metropolitan-Cammell Carriage & Wagon Co. Ltd. for 22 railcar trailer bogie frames.

Reference was made in our issue of December 21, 1951, to recent orders for Beyer-Garratt locomotives placed with Beyer Peacock & Co. Ltd., by the East African Railways. This Railway has now increased its order for the 4-8-2 + 2-8-4 80-lb. rail Beyer-Garratt engines from nine to 27 and has also increased the number for its standard lighter type (class "56") 4-8-2 + 2-8-4 from 16 to 24. The East African Railways already have nearly 100 Beyer-Garratt locomotives in service.

The Crown Agents for the Colonies have placed a contract with Cravens Railway Carriage & Wagon Co. Ltd. for the following rolling stock for the Gold Coast Railway:—

Carriages: six first class; three first and second class; eight second class; 30 third class; two five-car train sets of special lightweight construction.

Two mail, brake and baggage vans; six brake and baggage vans; one inspection car.

The Dunlop Rubber Co. Ltd. has stated that in addition to the 12 buses equipped with Dunlopillo seating, now in service in Tanganyika for the East African Railways & Harbours Road Services, a further 40 vehicles, also upholstered in Dunlopillo, have recently been ordered for service with that administration.

A recent Danish State Railways contract for diesel-electric locomotives, which it was stated in our April 4 issue, had been placed with General Motors Corporation, U.S.A., through that company's licensee for Europe, Nydqvist & Holm Aktiebolag, Trollhättan, Sweden (Nohab), has been the subject of further information by Nohab. It is pointed out that though the Danish State Railways have no contract with General Motors Corporation, they have placed an order for four diesel-electric locomotives with Nohab, and that a few years ago an agreement was signed between the Electro-Motive Division of the General Motors Corporation, and Nohab, under which Nohab is manufacturing and selling diesel-electric locomotives equipped with E.M.D. diesel engines and electrical equipment; the mechanical parts for these locomotives are designed by Nohab. The mechanical parts for three of the locomotives under the present contract, which are to Nohab design, will partly be manufactured by A/S Frichs, Aarhus, as subcontractors, though the locomotives will be assembled and finished in the Nohab workshops at Trollhättan.

The High Commissioner for Pakistan is inviting tenders for the supply of carriage and wagon axles. Further details are given under Official Notices on page 727 of this issue.

The closing date of the call for tenders for rails, cranes, diesel locomotives and various other equipment (No. 857), issued by the Rio Grande do Sul State Railway Brazil, has been extended from June 2 to July 3. The tender was previously referred to in our November 9, 1951, issue.

A recent Board of Trade, Special Register Information Service, report states that a call for tenders has been issued by the Belgian State Railways for 100 luminous ground signals, type "A" to specification, and two lots each of 500 luminous ground signals, type "B," to specification. Tenders should reach the Belgian State Railways, Brussels, by 9.30 a.m. on July 2. A copy of the tender documents, but not of the specification, is available for inspection at the Board of Trade, Commercial Relations & Exports Department, by representatives of United Kingdom firms. Reference CRE/21528/52 should be quoted.

The United Kingdom Trade Commissioner at Johannesburg has notified the Board of Trade, Commercial Relations and Exports Department, of a call for tenders issued by the South African Railways for the supply of one 52-lever all-electric power frame to South African Railways specification. Tenders should reach the Chairman of the Tender Board, Johannesburg, by 9 a.m. on July 17. A copy of the tender documents, including specification, is available for inspection at the Board of Trade by representatives of United Kingdom manufacturers, until June 30, after which date it will be available on loan in order of written application. Reference CRE/22027/52 should be quoted.

Notes and News

Vacancies for Transport Trainees.—A firm of food manufacturers require trainees, between 21 and 25 years of age, for its transport department. See Official Notices on page 727.

Crown Agents for the Colonies.—Assistant inspecting engineers are required for service on the engineering inspection staff of the Crown Agents, primarily in the United Kingdom. See Official Notices on page 727.

Mechanical Engineering Draughtsmen Required.—Applications are invited for the posts of senior and junior mechanical engineering draughtsmen required by company manufacturing diesel-electric locomotives. See Official Notices on page 727.

Vacancies on the Paraguay Central Railway.—Applications are invited for the posts of chief accountant, railway works manager, and traffic superintendent required by the Paraguay Central Railway for service in Paraguay. A knowledge of Spanish is essential. See Official Notices on page 727.

Services to Northern Ireland.—Mr. W. McCleery, Northern Ireland Minister of Commerce, has stated that the British Transport Commission's plans for improving services between Britain and Northern Ireland include two additional ships from Heysham, designed specially for freight traffic in containers and on trailers. He said is was also proposed to transfer from Larne to Belfast the Northern Ireland terminal of the Stranraer mail steamer service and to provide instead a daily service for passenger and goods traffic, except on Sundays, between Larne and Stranraer throughout the year. This daily service would be capable of duplication as required. Mr. McCleery said that a final decision on the questions had not been taken and he proposed to seek views of interested parties in Northern Ireland on the transfer of terminals.

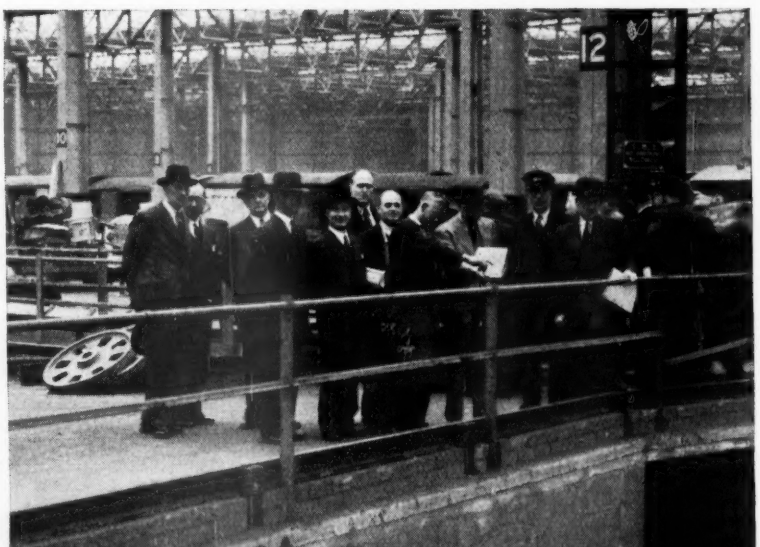
British Railways Steel Carryings.—During the week ended June 14, British Railways carried 212,675 tons of iron and steel, the second-highest weekly figure for over a year. During the weekend up to 6 a.m. on June 23, 274,560 tons of coal were cleared by rail from deep-mined pits and opencast sites, making 3,107,920 tons for the week.

Keith Blackman Limited Works Holidays.—The Arbroath Works of Keith Blackman Limited will be closed for summer holidays from 5.30 p.m. on July 18 to 7.45 a.m. on August 4. The company's Tottenham Works will be closed from 5.45 p.m. on August 8 to 8 a.m. on August 25. No goods will be despatched from the works during the periods mentioned, but goods inwards will be accepted.

A Golden Jubilee Celebration.—Representatives of the technical press were recently invited to tour the Worcester and Gloucester works of Heenan & Froude Limited and Fielding & Platt Limited, two of the principal members of the Heenan & Froude Group. The occasion marked the completion by the parent firm of 50 years as a public company. A luncheon was later held at the Guildhall, Worcester.

London Midland Summer Services.—The London Midland Region summer timetable which comes into operation on June 30 includes 19 more express trains and more sleeping berths. Twenty-five main-line trains have been accelerated by from 10

Mr. Elliot at Bristol Temple Meads Goods Station



Mr. John Elliot, Chairman, Railway Executive, with Mr. K. W. C. Grand, Chief Regional Officer, Western Region, and other officers of the Western Region on a recent visit to the mechanised goods depot at Bristol Temple Meads

OFFICIAL NOTICES

The engagement of persons answering Situations Vacant advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

MECHANICAL ENGINEERING DRAUGHTSMAN required by London Firm in Victoria area. Write stating details of age, experience, qualifications and salary asked.—Box 511, *The Railway Gazette*, 33, Tothill Street, London, S.W.1.

FOR SALE. Hangar (all steel) 113′ clear span × 135′ long × 25′ clear height at eaves, rising to 35′ clear at apex. Doors each end (gable optional). Hangar (all steel) 80′ clear span × 144′ long × 22′ clear height at eaves, rising 32′ at apex. Doors one end. Steel building 80′ clear span × 144′ long × 22′ clear height at eaves. Large sliding doors in sides. Curved steel building 35′ span × 17′ 6″ high at apex. Up to 600′ long (low price).—BELLMAN HANGARS LTD., Terminal House, London, S.W.1.

REQUIRED by well-known Food Manufacturers, trainees for their Transport Department. Age 21-25. Single men fully mobile with some transport experience preferred. Reply—Box 521, *The Railway Gazette*, 33, Tothill Street, London, S.W.1.

THE HIGH COMMISSIONER for Pakistan invites tenders for the supply of:—Carriage and Wagon Axles. Forms of tender which are returnable by July 29, 1952, may be obtained from the Commercial Secretary, Supply & Stores Department, 39, Lowndes Square, London, S.W.1, between the hours of 10 a.m. and 3 p.m. Mondays to Fridays, on payment of a fee of 5 shillings. The enquiry reference PRR.3580 should be quoted on all applications for tender forms.

GLOSSARY OF WOOD. A technical dictionary for all associated with timber and its uses. Ten thousand terms about timber—the common and the little known, the old and the new. Ten thousand definitions covering the entire field of timber and its uses—growth, marketing, utilisation. The commercial timbers, their qualities and uses, tools and woodworking equipment, are all here explained simply, concisely and accurately. Illustrated by many clear line drawings. Price 21*s.* net. By post 21*s.* 9*d.* Tothill Press Limited, 33, Tothill Street, London, S.W.1.

CROWN AGENTS FOR THE COLONIES

ENGINEERS, ASSISTANT INSPECTING required for service on the Engineering Inspection Staff of the Crown Agents primarily in the United Kingdom. Basic Salary Scale £575 × 25 — £750 × 30 — £800. The £575 minimum is linked to entry at age 25 and is subject to increase at the rate of one increment for each year above that age up to but not exceeding 34. Pay addition to basic salary payable as follows: 10% on first £500, 5% on salary over £500 An Extra Duty Allowance of 8% on basic annual salary plus pay addition also payable at present. Engagements will be on unestablished terms with a prospect, after satisfactory service, of appointment to the established and pensionable staff in due course, vacancies permitting. Fully qualified Officers of at least 27 years of age who have completed two years' satisfactory service are eligible under certain conditions for a special increase in salary of £75.

Opportunities. Opportunities for promotion to Inspecting Engineer, (maximum basic salary £1,050) and Engineer posts in the London Office with higher salaries are open to those who make this work their career.

Qualifications. Candidates aged 25-30 should be Corporate Members of one of the major engineering Institutions or have passed the qualifying examination for Associate Membership, or an equivalent examination. They should have served an apprenticeship or pupilage and have had subsequent experience in one of the principal branches of engineering such as locomotives or rolling stock, motor transport, pumps, electrical work, diesel engines or structural work, etc.

Duties. To visit manufacturers' works during the course of the fabrication of plant and equipment to advise and assist manufacturers in maintaining required standards and carry out inspection and tests on materials, components and finished units to ensure that the requirements laid down in contract specifications have been complied with, and that the equipment will function satisfactorily in service.

Conditions of Service. The selected candidates will be required to reside in one of the industrial centres in the United Kingdom but may be liable to transfer as the exigencies of the work demand and may be called on to make periodic visits to Continental works as well as works in this country.

Generous leave and sick leave allowances are granted. Travelling expenses and/or car mileage allowance, with appropriate subsistence allowances, are paid.

Apply at once by letter to the—CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1, quoting on letter M.29418.B., stating full names in block letters, age, whether married or single, full particulars of qualifications, experience, knowledge of French, German, or Italian.

JUNIOR TRAFFIC OFFICIAL with Railway Traffic apprenticeship experience required for the Southern Railway of Peru, age 20/25 years, single, knowledge of Spanish would be an advantage. Apply to the SECRETARY OF THE PERUVIAN CORPORATION LIMITED, 144, Leadenhall Street, London, E.C.3.

REQUIRED for the Southern Railway of Peru. Locomotive, Carriage and Wagon Senior Draughtsman 30/35 years of age. Qualifications: Must have served a full general apprenticeship in an Engineering workshop (preferably Railway) and have had at least five years' drawing office experience with some time in an executive capacity. A knowledge of Spanish an advantage. Future prospects. Apply to the Secretary, PERUVIAN CORPORATION LIMITED, 144, Leadenhall Street, London, E.C.3.

REQUIRED for the Central Railway of Peru, Railway Stores Assistant (Clerical). Qualifications: Secondary School Education and holding School Leaving Certificate, preferably with some previous commercial experience. Age from 23 to 30 years. Knowledge of Spanish desirable. Single man preferred with experience in a Stores Department of a British Railway or an Engineering concern. Apply to —THE PERUVIAN CORPORATION LTD., 144, Leadenhall Street, London, E.C.3.

SENIOR and Junior Mechanical Engineering Draughtsmen required by Company manufacturing diesel-electric locomotives. Experience of the mechanical design of bogies and underframes for electric or deisel-electric locomotives preferred. Excellent opportunities exist for eventual upgrading to Design Engineer. First-class conditions of service, including Staff Assurance, and good salaries for the right men. Please apply, giving full details of qualifications, training, experience, age, salary, etc., to—Box 518, *The Railway Gazette*, 33, Tothill Street, London, S.W.1.

PARAGUAY CENTRAL RAILWAY. Vacancies occur in Paraguay for:—(*a*) Chief Accountant, (*b*) Railway Woods Manager, (*c*) Traffic Superintendent. Knowledge of Spanish essential. For particulars write—Box A.E.976, CENTRAL NEWS LTD., 17, Moorgate, London, E.C.2.

BOUND VOLUMES.—We can arrange for readers' copies to be bound in full cloth at a charge of 25*s.* per volume, post free. Send your copies to the SUBSCRIPTION DEPARTMENT, Tothill Press Limited, 33, Tothill Street, London, S.W.1.

to 30 minutes. Seat reservations will be available on over 200 trains and full washing facilities have been restored on 30 main-line services. The 7.55 p.m. Euston-Stranraer boat train will be named "The Northern Irishman." A detailed review of the L.M.R. summer services appeared in our May 23 issue.

G.N.R. Centenaries Special Train.—Further to the paragraph in our June 20 issue, announcing the special train to be run between Kings Cross and York on September 28, we are informed that the return journey will begin at about 3 p.m. from York and the route will be that followed before the opening of the Towns Line in 1852, *via* Church Fenton and Knottingley to Doncaster and from Retford to Peterborough *via* Lincoln and Boston. London will be reached at about 8 p.m. The Railway Museum at York will be specially opened on that day in connection with the trip.

British Electric Traction Co. Ltd.—For the year ended March 31, 1952, the aggregate net profit of the group, after providing £960,027 (£850,804 for the preceding year) for taxation, is £1,176,375 (£1,211,426). Allowing for minority interests in subsidiaries, the proportion attributable to the parent company is £1.054,484 (£1,085,748). Deducting the balance of profits retained by subsidiaries, £399,601 (£446,501), the net profit of the parent company is £654,883 (£639,247). The directors propose a final dividend on the "A" deferred ordinary and deferred ordinary capital of 17½ per cent. making 25 per cent. for the year ended March 31 (same payments as for 1950-51). The dividends paid and proposed on the preference, preferred ordinary and deferred ordinary capital absorb £396,997 (£403,305) after which there remains a balance of £257,886 (£235,942) which is transferred to the undivided profits account. The annual general meeting will be held on July 24, at Winchester House, Old Broad Street, London, E.C.2.

Transport of Aircraft by Rail.—Ten naval "Seafire" aircraft, a first consignment of nearly 70 of these fighters, left Latchford (near Warrington) by special train on May 29 for Hawley in Surrey, where they are to be serviced. They are conveyed on special 40-ft. wagons, and the London Midland Region has had to make special arrangements for the journeys as the loads are "out-of-gauge" and a special route avoiding structures which might foul the aircraft has had to be worked out. The "Seafires," naval development of the "Spitfire" fighter, are being despatched from Latchford and Silloth.

Control Equipment for Blackpool Rail Coaches.—The first of 25 new rail coaches for the Blackpool Corporation was delivered to Blackpool on June 11, where it

Goods train conveying ten naval "Seafire" aircraft, first of 70 being sent from Latchford (near Warrington) and Silloth to Hawley

was approved for passenger service by Brigadier C. A. Langley, Inspecting Officer of Railways, Ministry of Transport, after exhaustive tests. The Vambac control equipment of these vehicles was developed and supplied by Allen West & Co. Ltd., of Brighton. Its characteristics were described briefly in our June 13 issue, in which one of the cars was illustrated. The metal-framed bodies and underframes are being built by Charles Roberts & Co. Ltd.

C. A. Parsons & Co. Ltd.—A final dividend of 6¼ per cent., less tax, is recommended on the ordinary capital of C. A. Parsons & Co. Ltd. doubled by a share bonus which, with the interim dividend of 7½ per cent. on the smaller capital, makes a total of 13¾ per cent. for 1951. A total dividend of 15 per cent. was paid for 1950 on the smaller capital. There was a profit for 1951 of £1,037,452 (£656,589 for 1950) after deducting all charges, including taxation of £1,156,500 (£748,000), and after setting aside £30,000 (£50,000) for contingencies.

Institution of Railway Signal Engineers, Western India Section Meeting.—At a recent meeting of the Western India Section of the Institution of Railway Signal Engineers, when Mr. H. C. Towers, Chairman, presided, Mr. D. M. Cruickshank read a paper entitled "Signalling on the former Assam Bengal Railway." He gave an account of the reasons which prompted the administration to standardise a system of three-aspect semaphore signalling for all new installations. A red light or horizontal semaphore arm signifies "stop"; a yellow light or semaphore at 45 deg. "caution"; and a green light or semaphore at 90 deg. "clear." This equipment reduced the number of signals needed, without prejudicing safety.

British Transport Officers' Guild.—The fourth annual general meeting of the British Transport Officers' Guild was held in London on May 20. In submitting the report on the financial position, the Master referred to the very satisfactory position that for the year receipts had exceeded expenditure by £877. The alterations in the constitution of the Guild were now working satisfactorily. They had been disappointed in not yet concluding an agreement with the Road Haulage Executive in so far as the establishment of negotiating machinery was concerned and it had not been possible to make much progress with the London Transport Executive. When their membership in any particular Executive was below 50 per cent., the negotiating position was very difficult. Referring to the Government proposals to denationalise road haulage, he said that the proposals set out in the White Paper were too vague to give any real indication at this stage of what would be involved, but developments would be watched closely.

Forthcoming Meetings

June 27 (*Fri.*)—St. Christopher's (Railway Orphanage) Derby. Annual Meeting, and Distribution of Prizes by Sir Ronald W. Matthews, President of the Railway Benevolent Institution, and Lady Matthews. Annual Meeting in the Committee Room at 2.15 p.m.; Distribution of Prizes in the Dining Hall at 3.15 p.m.

June 28 (*Sat.*).—Permanent Way Institution, Leeds Section. Visit to Edgar Allen & Co. Ltd., Imperial Steel Works, Sheffield.

Railway Stock Market

General conditions in stock markets have remained unchanged; business was on a small scale, with buyers following a waiting attitude and moderate selling tending to have a disproportionate effect on values. Further falls in gilt-edged stocks dominated sentiment, though there was less talk of higher bank rate possibilities. Much selling of British Funds is by industrial companies requiring more money and unable to increase bank loans. The position could be met by new issues of shares, but public issues are unlikely to meet with success while markets are depressed. Moreover, recent offers of additional shares to shareholders have met with an indifferent response; over 50 per cent. in some cases had to be taken up by underwriters.

Although it is generally believed that many industrial shares have fallen unduly in price and have reasonable prospects of maintaining dividend rates, it is felt in the City that a better tendency in industrial sections of markets is unlikely until sentiment is helped by a rally in British Funds. The present trade recession may not be the start of a general slump, but it seems largely a reflection of the adjustments inevitable in the process of switching production, financial resources, and labour into rearmament and kindred activities.

Foreign railway stocks have attracted only moderate attention. There has been some buying of United of Havana stocks, among which the 5 per cent. debentures rallied to 14 before easing to 13¾, though there is no news from Havana of any fresh take-over developments. Antofagasta stocks failed to hold an earlier improvement, the ordinary having receded to 10¾ and the preference to 51.

Brazil Railway bonds were better at 6 on latest market estimates of prospects. Leopoldina ordinary were kept steady at 11, and the preference stock at 28. Leopoldina Terminal debentures were 20 with the ordinary units quoted at 8d.

Manila stocks encountered a little selling, which put the "A" debentures easier at 74 with the 5 per cent. preference 8s. 6d. Nitrate Rails shares changed hands around the better level of 20s. 6d., and Taltal were 14s. 6d. Mexican Central "A" debentures were 68½.

Canadian Pacifics have been easier at $64¾ with the 4 per cent. preference stock 60½xd. and the 4 per cent. debentures 78½. At their current level the preference stock yields over 6½ per cent., which seems a generous return. This stock is non-cumulative as to dividend but there is substantial cover for dividend requirements.

Chilian Northern 5 per cent. debentures were 30, Bolivar "C" debentures 50½, and Costa Rica 6½ per cent. first debentures 46, while Guayaquil & Quito 5 per cent. first debentures were 27½, but quotations have been tested by very few dealings this week.

There was not much business among road transport shares, which are held firmly, largely as permanent investments. There are few sellers, because it is generally believed that there are reasonable prospects of dividends being maintained. Lancashire Transport were 38s., Southdown 72s. 6d.xd, West Riding 28s. 6d. and East Kent Road Car marked 60s. B.E.T. deferred stock was £340 awaiting the full report and chairman's annual statement.

Engineering shares kept quiet, though tending to firm up a little in price. This is partly because it is realised that some sections of the industry are likely to be well employed, because of rearmament and also of the big efforts expected to be made to expand export trade.

Guest Keen changed hands around 48s. 3d.; Tube Investments were 49s. 6d., T. W. Ward 69s., John Brown 38s. and Vickers have been steadier at 40s. 3d. Ransome & Marles were 21s. 10½d., and Ruston & Hornsby 31s. 7½d. Brush Electrical and Associated British Engineering were both around 4s. 7½d. after market rumours that a scheme of amalgamation involving raising of additional capital may be proposed.

Beyer Peacock changed hands around 27s. 6d.; Hurst Nelson were 49s. and North British Locomotive firmed up to 13s. 9d. after receding to 13s. 6d. Birmingham Carriage were 32s. 3d., Vulcan Foundry 21s. 3d., Gloucester Wagon 10s. shares 11s.; Charles Roberts 5s. shares were 19s. 9d., Wagon Repairs 5s. shares 11s. 9d.

RAILWAY BENEVOLENT INSTITUTION.—The Board on June 18 granted annuities to widows and members involving additional liability of £252 a year. Gratuities were granted amounting to £569. Grants from the Casualty Fund during May amounted to over £700.

Traffic Table of Overseas and Foreign Railways

	Railway	Miles open	Week ended	Traffics for week: Total this year	Traffics for week: Inc. or dec. compared with 1949/50	No. of week	Aggregate traffics to date: Total 1950/51	Aggregate traffics to date: Increase or decrease
				£	£		£	£
South & Cen. America	Antofagasta ...	800	13.6.52	153,090	– 350	24	3,738,270	+ 1,030,170
	Costa Rica ...	281	May, 1952	c1,552,666	+ c986,013	48	c14,398,842	+ c4,220,309
	Dorada	70	May, 1952	32,469	– 2,714	22	166,616	– 10,601
	Inter. Ctl Amer....	794	Apr., 1952	$1,085,825	+ $214,744	17	$4,754,984	+ $130,795
	Paraguay Cent. ...	274	13.6.52	G419,216	+ G185,889	50	G17,964,733	+ G7,454,312
	Peru Corp. ...	1,050	May, 1952	$8,680,000	+ $856,000	48	$92,012,000	+ $7,791,000
	,, (Bolivian Section)	66	May, 1952	Bs.19,347,000	+ Bs.1,468,000	48	Bs.181,091,000	+ Bs.36,709,000
	Salvador	100	Mar., 1952	c225,000	– c11,000	39	c1,607,000	+ c44,000
	Taltal	122	May, 1952	$3,818,000	+ $1,562,000	48	$25,978,000	+ $7,109,000
Canada	Canadian National†	23,473	Apr., 1952	17,908,000	+ 1,089,000	17	71,822,000	+ 7,364,000
	Canadian Pacific†...	17,037	Apr., 1952	11,982,000	+ 300,000	17	47,926,000	+ 3,542,000
Various	Barsi Light* ...	167	May, 1952	29,565	+ 2,895	4	66,825	– 15,862
	Gold Coast ...	536	Apr., 1952	323,411	+ 29,019	4	323,411	+ 29,019
	Mid. of W. Australia	277	Mar., 1952	52,253	+ 11,130	39	522,599	+ 165,102
	South Africa ...	13,398	24.5.52	1,890,547	+ 112,394	8	15,278,301	+ 792,578
	Victoria	4,744	Feb., 1952	2,176,542	+ 436,697	35	—	—

* Receipts are calculated at 1s. 6d. to the rupee † Calculated at $3 to £1